Pit and Quarry

Published Bi-weekly on Wednesday for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and other Non-Metallic Minerals

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THE HAISS EXCAVATOR

Pit and Quarry

Vol. XVIII CHICAGO, ILL., JULY 3, 1929 No. 7

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is taken from our files and its selection is without significance as to current events or as to the position of the individual in the industry.

Charles Boettcher
President, Ideal Cement Company
Denver, Colorado

First Central Concrete Mixing Plant In Mobile, Alabama, Now Operating

THE acceptance of central concrete mixing plants in the South in general has progressed more slowly than in the North. This is especially true among the Gulf states, largely because of the few cities in those states considered large enough to support such a plant. Several new plants have been put into operation recently, however, and a number more are planned or under construction.

A new plant was recently put into operation at Mobile, Alabama, a city with about 65,000 inhabitants. This plant is operated by the Mobile Ready Mixed Concrete Company, Incorporated, and uses the most modern equipment. It is located at the foot of Palmetto Street on the west bank of the Mobile river in one of the busiest industrial sections of the city and only a short distance from the heart of the business section.

The sand and gravel used in the concrete is purchased from a material company whose yard occupies the property adjoining the plant on the south. The sand and gravel is dredged out of the Alabama and Tombigbee rivers north of Mobile and hauled to the yard in barges. That required for the concrete plant is unloaded direct from the barges by a huge steam gantry derrick owned by the material company. This derrick travels on rails parallel to the dock and operates a 2-yd. Williams bucket. It has a span of 75 feet on the dock side and 85 feet on the stockpile side. Any rehandling necessary is done by a Link-Belt gasoline crane with a ¾-yd. clamshell bucket which stores the various sizes of material in stockpiles near the con-

R. W. Greene, Jr., General Manager of Mobile Ready Mixed Concrete Company

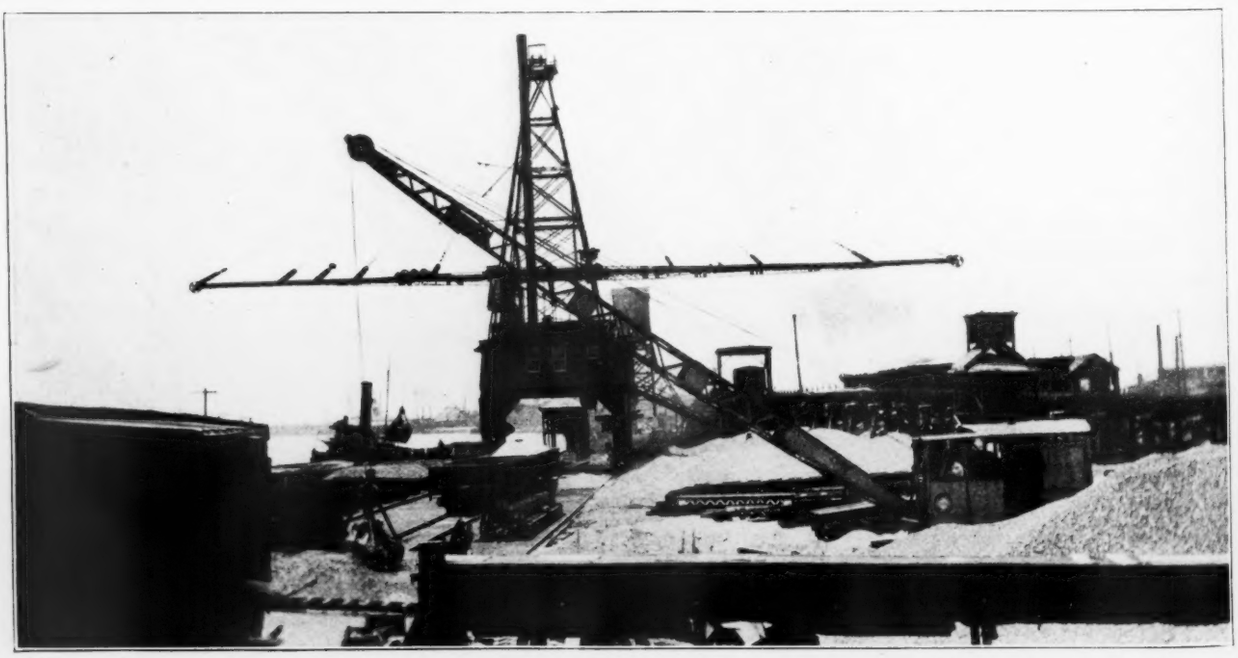
Central Mixing Plant and Stiffleg Derrick at Left. Crane for Rehandling of Aggregate at Right

Steam Gantry Derrick Unloading Material from Barge Into Stockpiles and Bins. Towboat in River Maneuvering Barges Into Position for Unloading

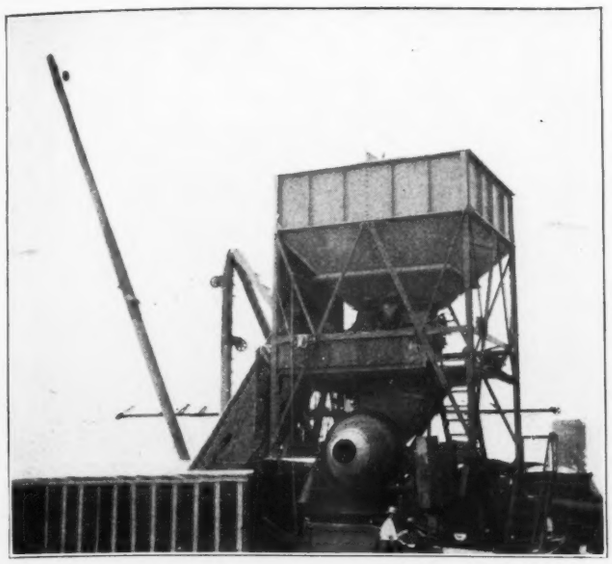
crete plant. The sand varies in fineness so that no mixing of sands is required and the gravel is screened on the dredges to any sizes specified.

A stiff-leg timber derrick with a 70-ft. boom loads the material from the stockpiles into the bins over the mixing plant. The derrick handles a ¾-yd. Blaw-Knox clamshell bucket and is operated by a Clyde three-drum hoist driven by a 40-hp. electric motor. American Hoist and Derrick Company fittings and American Steel and Wire Company cables are used.

The plant building is of structural steel with a Blaw-Knox steel double bin with a total capacity of 102 tons for the aggregates. The bins discharge



Car of Cement in Foreground Being Unloaded Into Covered Conveyor to Storage Shed. Crane in Middle Distance Rehandling Material from Stockpile to Plant



Mixing Plant With Truck in Position for Loading

into a Blaw-Knox double beam weighing batcher equipped with a Fairbanks scale showing the last 200 pounds on a dial. The batcher discharges through a chute to the Smith 1-yd. tilting type mixer. The mixer is driven by gear and pinion by a 20-hp. Allis-Chalmers motor. Cement is added by hand on the mixer platform.

Cars of cement are run onto a siding at the plant. A 90-ft. Logan inclined gravity conveyor carries the sacks to a 600-bbl. capacity storehouse near the mixing plant. The conveyor is enclosed so that cars can be unloaded in any kind of weather. An enclosed elevator lifts the sacks to the mixing platform. Empty sacks go through a chute from the mixing floor to the cement house where a sack shaker and baler takes care of them.

The output is going largely to county and city construction work and to buildings going up in the vicinity. Delivery is made in Indiana 1- and 2-ton steel body dump trucks. R. W. Greene, Jr., is general manager of operations and maintains his office near the plant.

Conveyor to Cement Shed. Truck Being Loaded at Concrete Plant

National Lime Association Holds Annual Meeting

The annual meeting of the National Lime Association held a most interesting and epochal meeting June 26, 27, 28, at the Mayflower Hotel, Washington, District of Columbia. The meeting had been deferred until such time as a session could be held with members of the Federal Trade Commission in attendance.

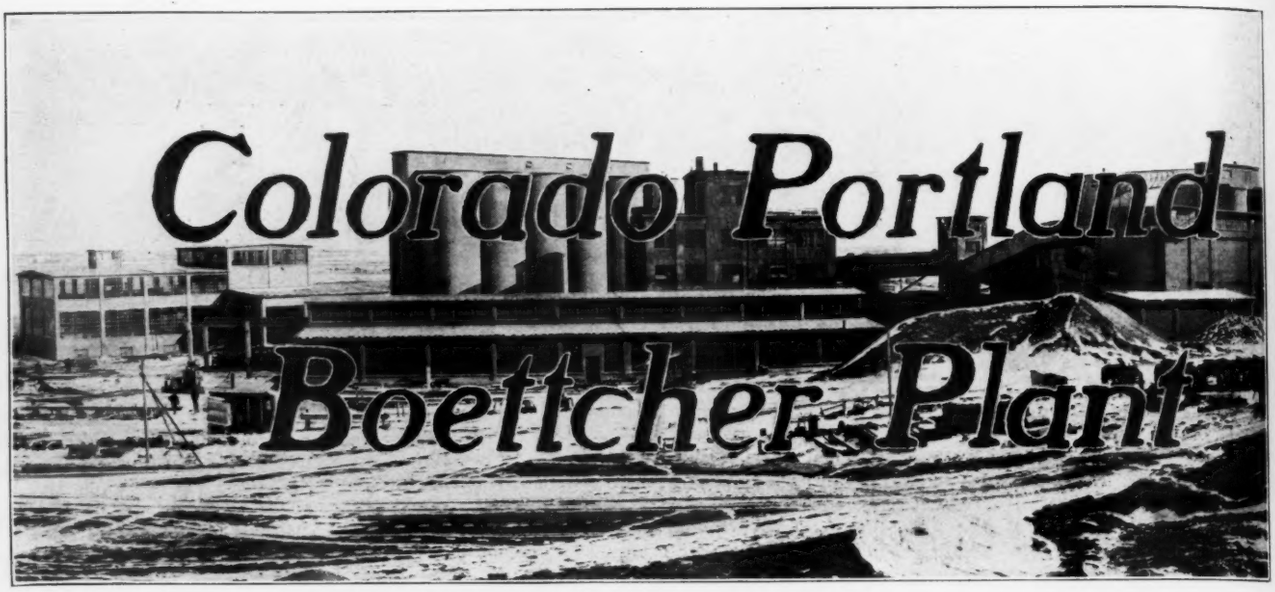
The first day's session was devoted exclusively to the preparation and discussion of a proposed code of practice that is intended to be enforced in the lime industry. On the second day the twenty-four rules in this tentative code were presented in an open meeting presided over by Director M. Markham Flannery and the Honorable Commissioner W. E. Humphrey of the Federal Trade Commission, who accepted the code for the board's consideration after the summer recess.

The members of the association elected their directors from the several districts and these, in turn, held the annual election of officers, which resulted in advancing Norman G. Hough, by making him president in addition to manager. The chairman of the board of directors for the coming year is Bernard L. McNulty, president and general manager of Marblehead Lime Company, Chicago, Illinois. The new secretary-treasurer is Ralph P. Wilson, president of Steacy and Wilton Company, Wrightsville, Pennsylvania. The executive committee comprises J. M. Gager, president of Gager Lime Manufacturing Company, Chattanooga, Tennessee; Reed C. Bye, vice-president, The Warner Company, Philadelphia, Pennsylvania; J. M. Deely, vice-president, Lee Lime Corporation, Lee, Massachusetts; and H. B. Matthews, Jr., vice-president, Mississippi Lime and Material Company, Alton, Illinois.

The serious proceedings were spaced by a wonderful banquet that was enlivened by the songs and dancing of professional performers. A full account of the meeting will appear in our next issue.

Sand and Gravel Plants Are Worth $400,000,000

Since 1908 the sand and gravel industry has grown 432 per cent and in 1927 it did a national business amounting to $115,529,000, according to figures compiled by the U. S. Department of Commerce. The industry's investment in plants and machinery is estimated to be $400,000,000. In sand and gravel consumption for construction and development work Illinois ranks second, New York first, Michigan third, and California fourth.



Boettcher Plant of Colorado Portland Cement

THE new Boettcher plant of the Ideal Cement Company of Denver, erected near Fort Collins, Colorado, at a cost of $2,500,000, has a daily capacity of 14,000 sacks of cement, with a force of from 150 to 175 men. It has sufficient raw material in sight, in proximity to the plant, to keep it running for a great many years. The fact that this material is easily quarried from an open face, and the most modern scientific machinery has been installed for handling the product from the quarry to the loading into cars for shipment, make this one of the most economical cement manufacturing plants in existence. Its record of production per B.t.u. of fuel has attracted considerable attention of engineers and manufacturers all over the world.

The nature of the raw materials, a deposit of argillaceous shale, laid down in strata of varying lime content which dip about 18 degrees toward the east, a scarcity of water and other considerations influenced the engineers in deciding upon a dry process plant. Mixing and blending processes are used to bring the cement within a fraction of one per cent of perfect, which is a uniformity of quality not exceeded to date by any wet process plant.

Electric Shovel in Quarry

The Boettcher plant is constructed throughout of reinforced concrete and is one of ten plants operated by the same company in Colorado, Montana, Utah, Oklahoma, Nebraska and Arkansas. The first plant erected by the company at Portland, Colorado, over twenty-five years ago, has operated from the start by the dry process used at the Boettcher plant. The latter plant attains results equal to those of wet plants, without their disadvantages.

On opening the Boettcher plant, the entire surface of the quarry was drilled to a depth of fifty feet with two Armstrong well drills, and blasted. Three cuts were started through this area in which standard gauge track was laid for the Easton all-steel quarry cars in which the shale is hauled to the plant. Two locomotives are used alternately for pulling the cars in ten car trains. A Marion 70 steam shovel, on crawlers, and a Bucyrus 125B high lift shovel with Ward-Leonard control, are used to load the shale in the 11-yard cars. Only a few minutes is required to load a train of cars. After the layer of 50 feet, which has been shot, is removed from the quarry, another layer will be blasted and it is estimated that there is at least a hundred years' supply of raw material to be obtained by open quarrying.

At the primary breaker, equipped with an Allis-Chalmers Fairmount roll crusher, 36-in. by 60-in., driven by a 150-hp. Westinghouse motor, the cars are speedily dumped by means of a swinging hook and cable, operated by an air cylinder, raising one side of the car body. From this crusher the shale is conveyed in an Allis-Chalmers 42-in. inclined pan elevator to a 400-ton bin on the third floor of

Company Has Interesting Features

BY JOS. C. COYLE

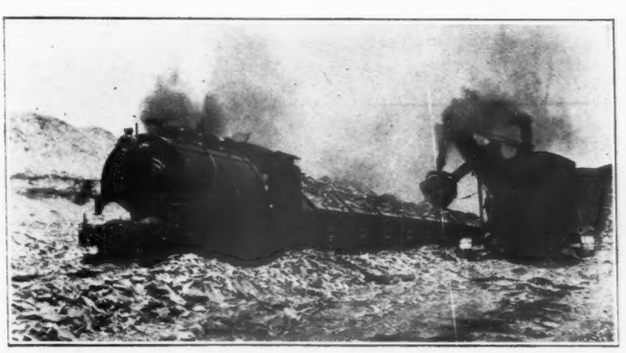
the crusher building. From this bin the shale is fed by a Stephens-Adamson feeder to a Williams Jumbo No. 9 hammer mill. After being reduced by this mill, on the ground floor of the crusher building, and sampled by an Allis-Chalmers Bridgeman sampler, the material is elevated again to the second floor, where a certain proportion of it drops through a chute into a sample mill from which samples are taken every hour to the laboratory. The rest of the shale drops on a 24-in. conveyor belt, which carries it to eight 25-ft. by 65-ft. storage tanks. A Merrick weightometer records the weight as the material passes over. Later, the shale is twice sampled by Vizen samplers before it reaches the dryers.

A secondary conveyor belt, at the end of the one just described, and mounted on an adjustable carriage, may be set to deliver the rock into either of the eight storage bins into which, by reason of its lime content, it may belong. This is determined by the hourly sampling. The proper mix is secured by the use of Schaffer poidometers which feed the shale from two or more storage bins, or tanks, to a drag of 14-in. Bethlehem steel chain that delivers it to an elevator that in turn carries it up into two 30-ton feed bins of the dryers. There are two of these Traylor revolving dryers, 70 feet long by 7½ feet in diameter, driven slowly by 30-hp. motors, with Cleveland gear reducers. A natural gas flame is used in the dryers.

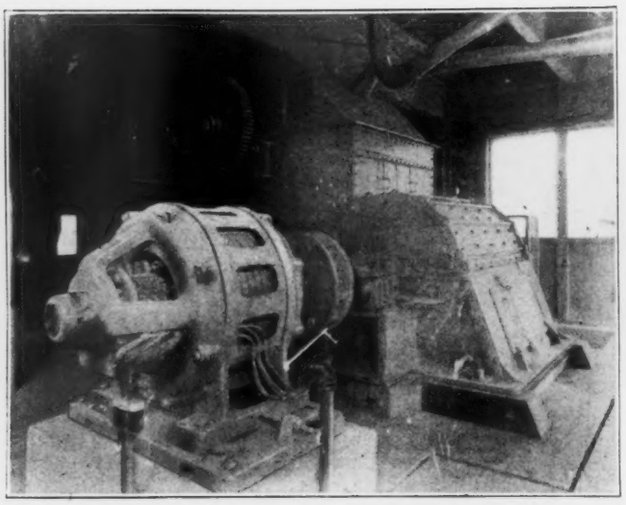
From these dryers the rock is carried by screw conveyors to bucket elevators. These deliver the material to screw conveyors, which drop it into the 140-ton tanks which feed the Traylor grinding mills. There are five of these mills, two for raw material, two for clinker, and a No. 3 compeb mill which may be used for either. Each mill carries a charge of 120,000 lb. at one-half full, and has a capacity of 400 sacks per hour. They are each direct-connected to a 600-hp. synchronous Westinghouse motor, located in an adjoining room. A 10-ton Milwaukee crane operates over the mills and a 5-ton Armington hand crane above the motors.

A screw conveyor takes the shale from the raw mills to a 10-in. Fuller-Kinyon pump, operated by a 60-hp. motor. The material then goes to three 14-ft. Sturtevant air separators, in another building, or is by-passed directly to the blending tanks if desired. These separators are driven by a 100-hp. motor and two others, used for cement, are attached to one 50-hp. motor. A Fuller-Kinyon pump delivers the finest of the product from the raw separators to the blending tanks, while another returns that which is too coarse to the mills. There is a third pump for emergency service.

A Fuller-Kinyon electric control board automatically switches the raw shale to the blending tanks, where it is kept moving back and forth from one tank to another by pumps of the same make. This interchange of material from one tank to another serves to correct any error in mix which may exist. From the blending tanks the dust is



Steam Shovel Loading Train of Quarry Cars



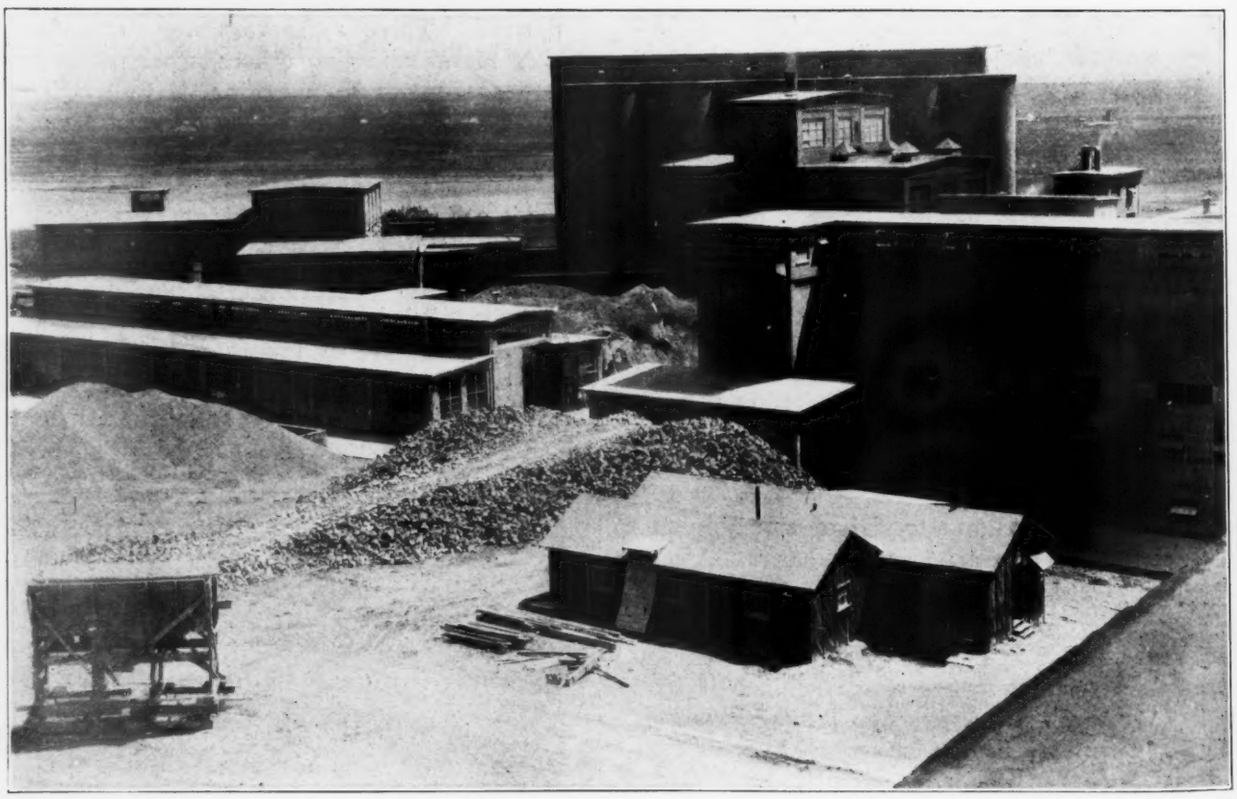
Hammer Mill

Close-up of 11-Cu. Yd. Quarry Car

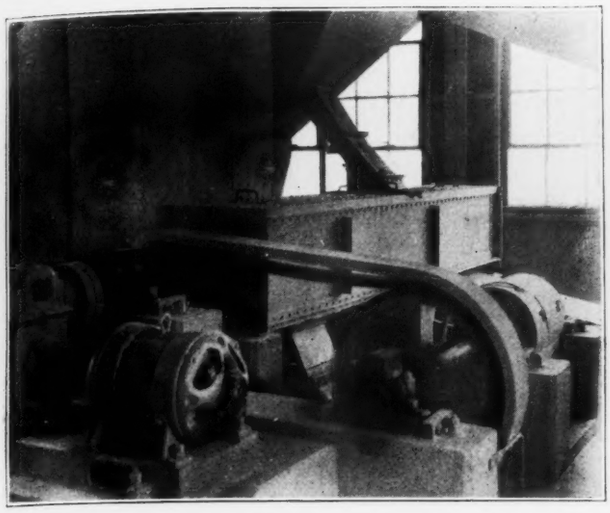
Dryers in Colorado Portland Cement Plant

next pumped to the feed tanks of the kilns, whence it is fed to the latter by bucket conveyors.

The two Traylor rotary kilns are 175 feet long and 11 feet in diameter, with a drop of one-half inch to the foot toward the discharge end. Each is run by a 75-hp. variable speed motor, at a speed of from 1½ minutes to 5 minutes per revolution. One kiln is partly lined with Sil-O-Cel, while the other has a fire brick lining. They have a capacity of 1,000 barrels every twelve hours. For about two months after the plant opened, it was fired with pulverized coal, provided by a Raymond coal mill. This mill powdered the coal, dried it with hot air from the coolers, and it was then blown



Portion of Boettcher Plant: Machine Shops (Left) and Packing House (Left Back); Gypsum Pile (Center); Mill House (Right) and Silos (Right Back)

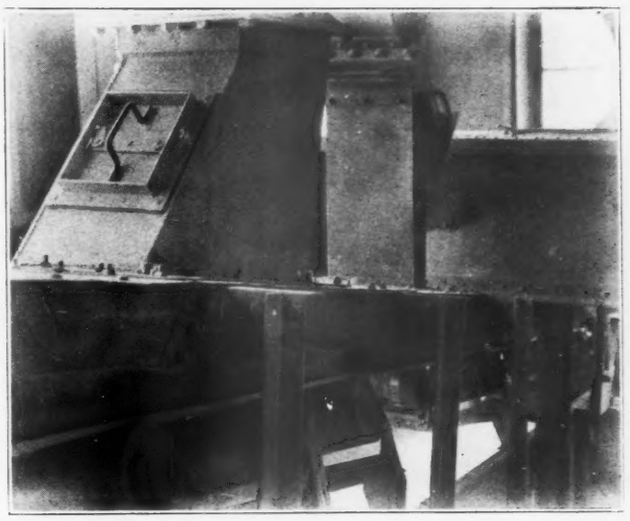


Sample Mill in Crusher House

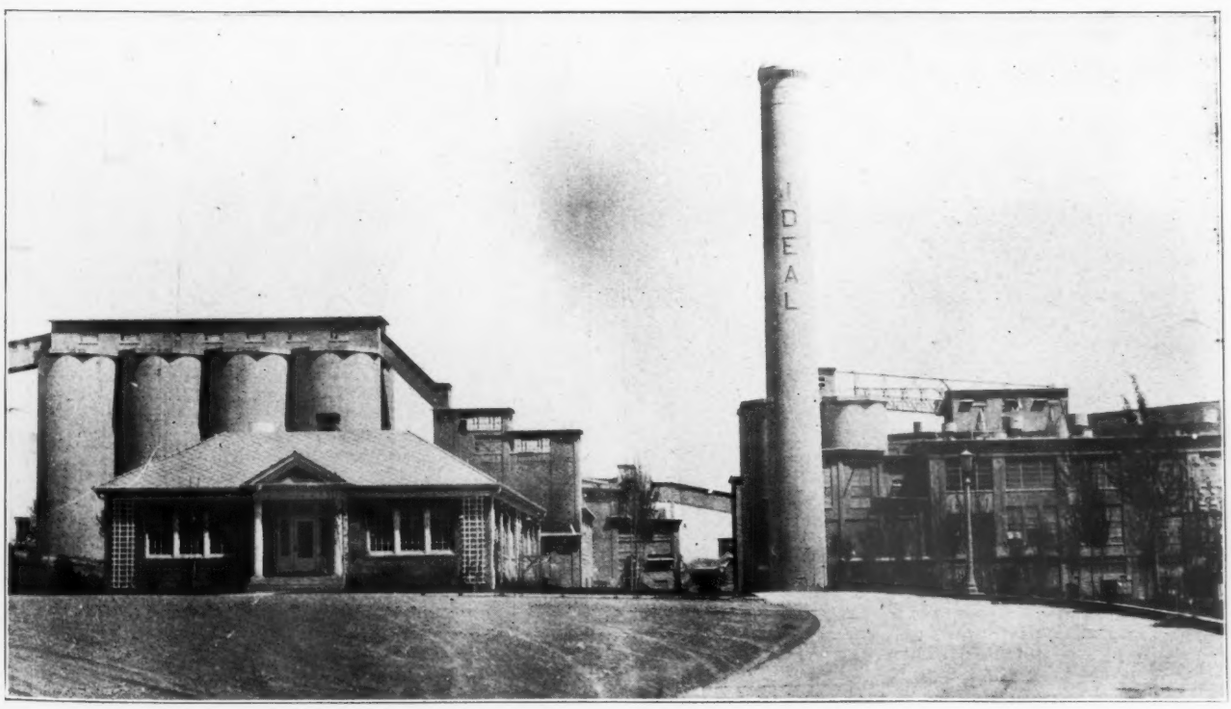
Grinding Mills for Raw Shale and Clinker

into the burners. The kilns are now fired with natural gas. Waste heat from the kilns is conveyed to the boiler room and used to generate all steam for the plant, in two Edge Moore waste heat boilers. Two Green induced-draft fans draw the gases through the boilers. The latter are fitted with Coppus boiler-feed regulators and Foster super-heaters. After passing through the fans and a Cottrell dust precipitator, the gases escape through the 150-ft. Rust concrete stack. No fuel is required for generation of the 225-lb. of steam pressure which is maintained on the boilers.

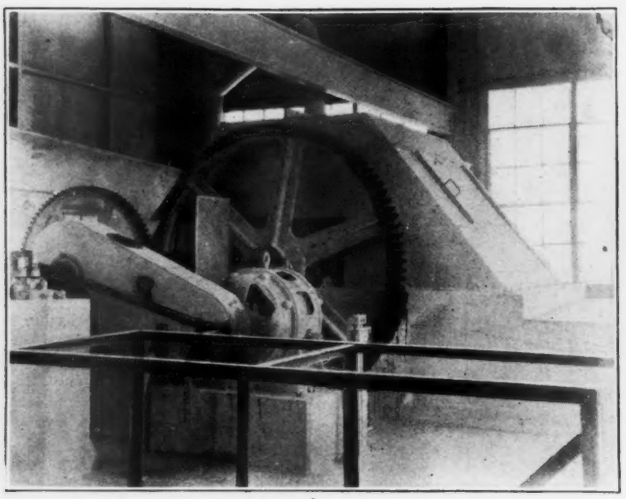
Directly beneath the kilns are two Traylor coolers, 70 feet long by 7½ feet in diameter, which receive the clinker from the kilns, and where it is cooled by fresh air from a Sturtevant fan, with an Allis-Chalmers Texrope drive from a motor, and



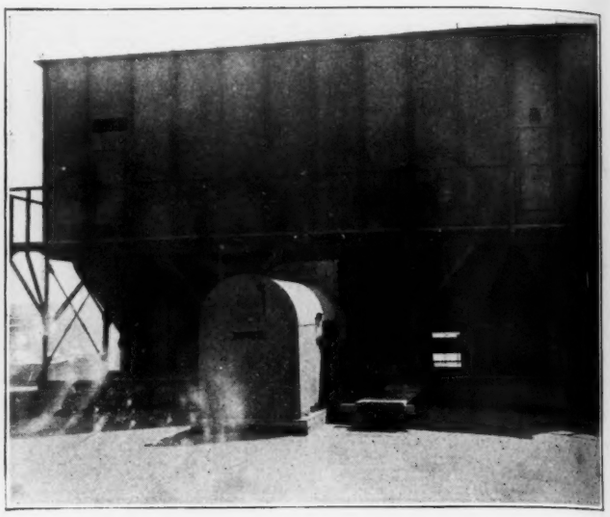
Hopper for Crushed Rock to Conveyor. A Seven Per Cent Sample Drops Into Chute at Back



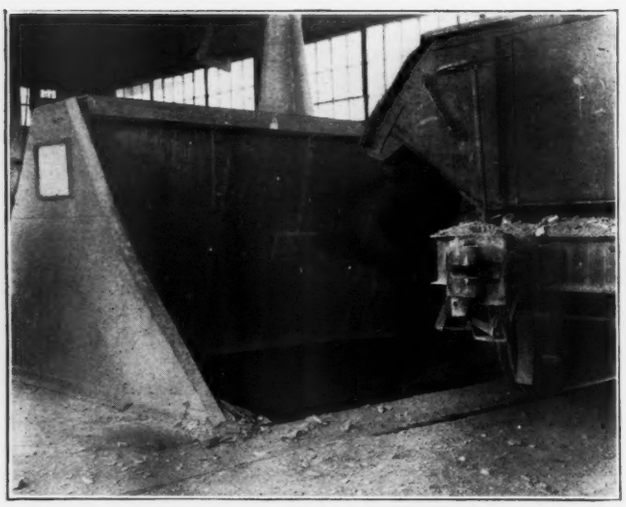
Front View of Boettcher Plant: Office and Raw Storage (Left), Blending Tanks and Power House (Right)



Motor and Housing of Conveyor from Primary Crusher to Storage Bin, Above Hammermill



Dust Collectors Over Primary Crusher

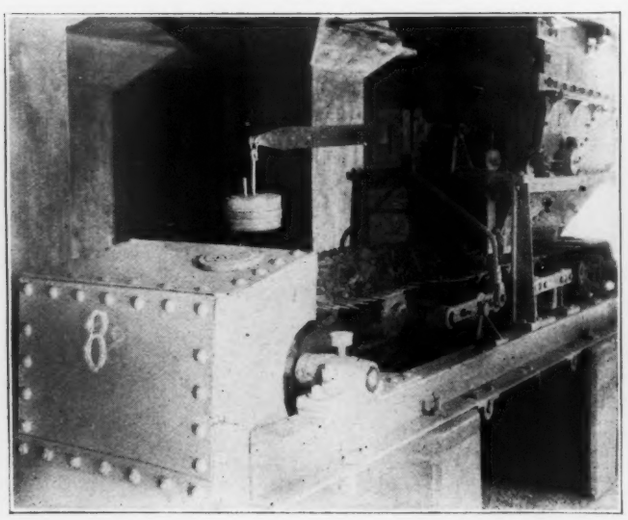


Mouth of Primary Crusher, With Dust Collector

by a continuous sheet of cold water on the outside of the cooler. The hot air leaving the coolers is relieved of its dust content in passing through a dust chamber beneath the coolers and is then used in connection with the natural gas used in firing the kilns. The temperature of the air is such that it aids in the combustion of this gas.

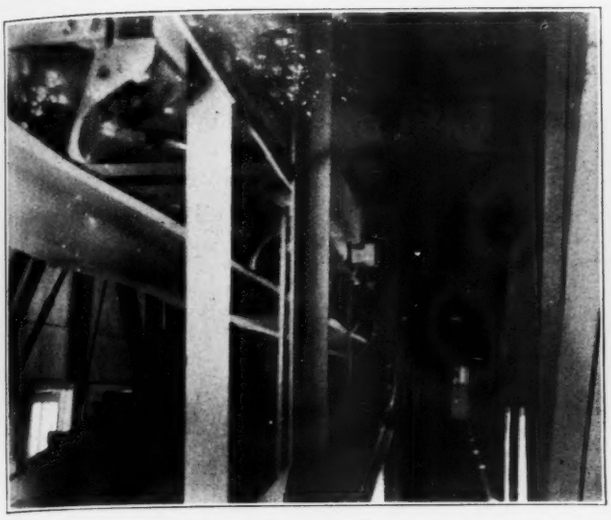
The only ingredient of cement which is shipped into Boettcher is gypsum, which is kept in open storage at the back of the plant. This is ground in an open rotary mill, from which it is conveyed in the raw state to a concrete storage bin. The gypsum is drawn from this bin, measured by an automatic feeder, and added to the clinker before the latter enters the clinker mills.

After the clinker is ground, the product is handled altogether by Fuller-Kinyon pumps, being mixed with air from the Ingersoll-Rand com-

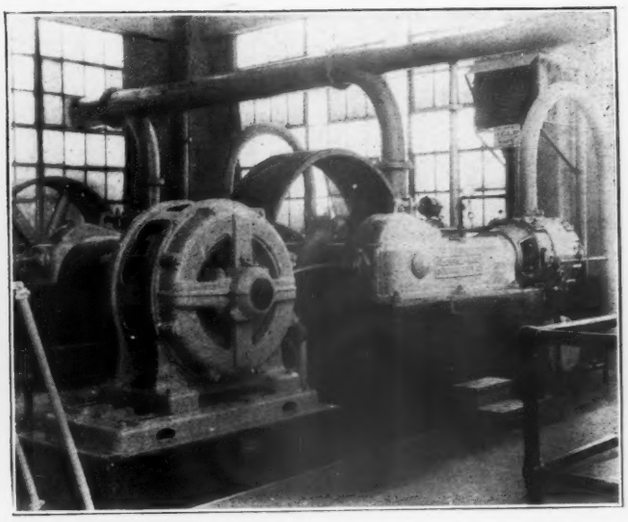


One of the Automatic Weighing Machines

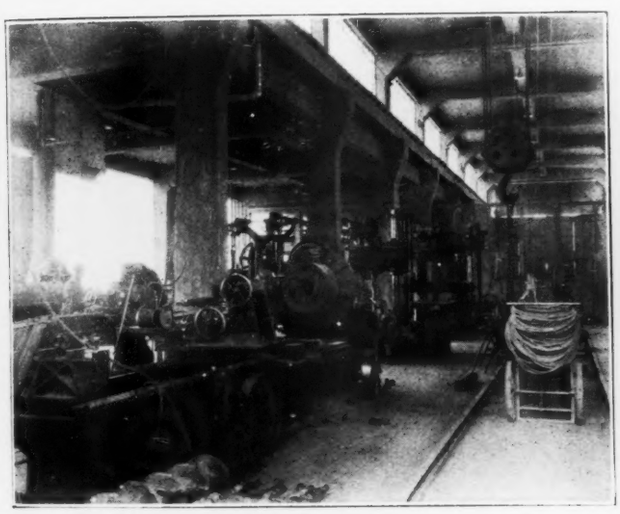
Bag Cleaner



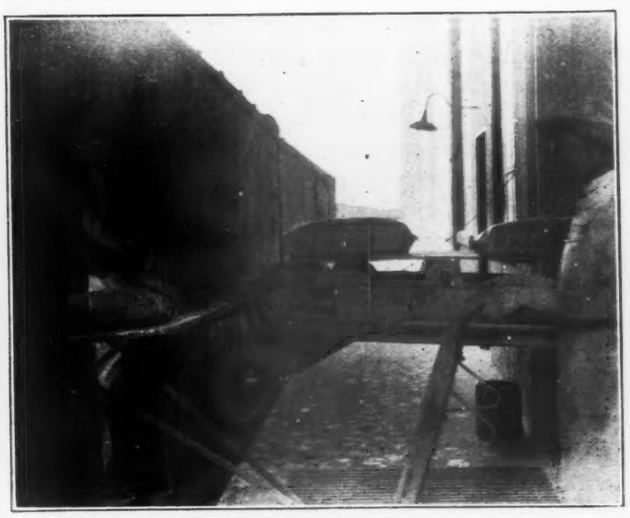
Conveyor From Crusher House to Mill-Feed Tanks



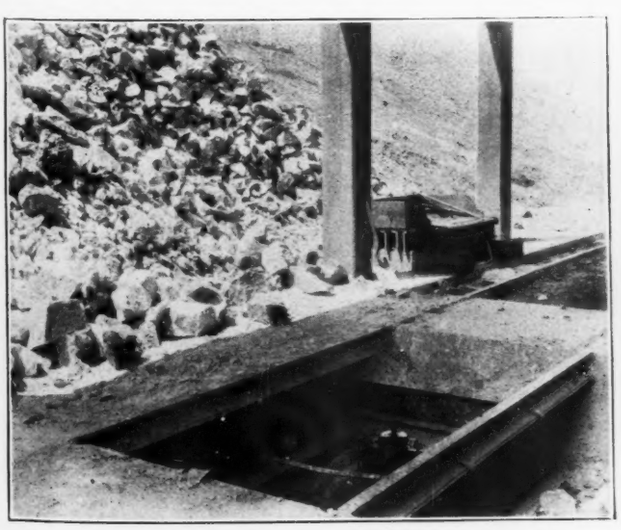
One of Five Air Compressors



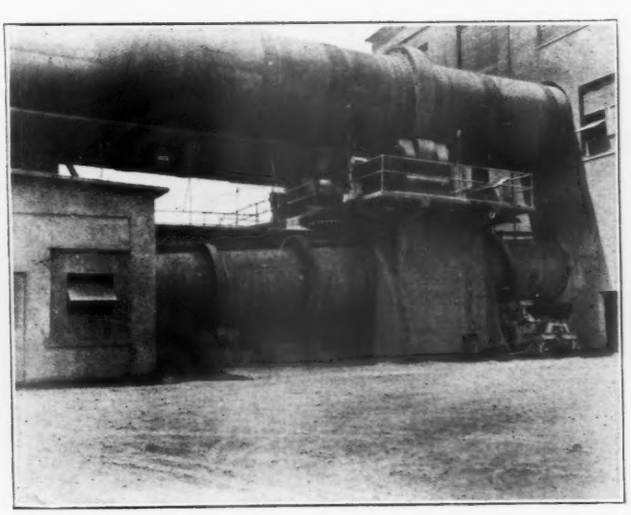
Interior of Machine Shop



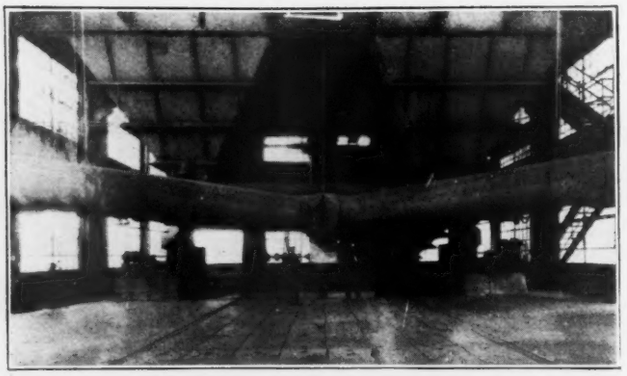
Loading Sacked Cement Into Freight Cars



Gypsum Storage Pile and Rotary Crusher



Kilns and Coolers



Pipes Carrying Gas or Coal Dust to Kiln

pressors. It is either pumped directly into the silos constructed for the finished cement, or to the two finish air separators when an extra fine product is desired. There are 12 silos of concrete, 80 feet high and 30 feet in diameter. The group is placed on a concrete base five feet wider than the silos, to prevent settling. The delivery of cement to the silos may be controlled either automatically, the stream entering the tanks in regular rotation, or at the will of an operator at an electric control board on the ground floor.

Six 3-tube Bates packers are used in the packing plant, delivering the packed product to a spur on each side of the building. The cement is drawn from the silos and delivered to the packers by two 8-in. Fuller-Kinyon pumps mounted on rails the length of the tanks. A control board automatically shifts the feed from one packer to the other in rotation. A belt conveyor carries the filled bags into the doorway of the railroad car, where it is loaded by laborers. A Bates bag cleaner, manufactured by the Vulcan Iron Works, of Denver, is used to clean the sacks, after which they are sorted, mended and tied. Sly dust collectors are installed in the packing rooms, as well as in the crusher building and other parts of the plant, and the entire plant is remarkably free from dust.

All motors in the plant are Westinghouse and in the power plant is a turbo-generator of the same make. Motors in the plant are divided into groups, with control racks at points convenient for the operators, and starting machinery is equipped with a nammeter so the operators may know the output of equipment and watch the loading. Normally a surplus of power is generated at the plant, which, since the company's power house is interconnected with the lines of the Public Service Company of Colorado, is furnished to the latter company. On the other hand, in case of need, power from the Public Service Company may be applied to this plant.

There is a machine shop and warehouse 65 feet by 180 feet, with a railroad track running the length of it for unloading heavy machinery, which is handled by a Milwaukee 10-ton crane. Machine shop equipment includes a Lincoln welder, Oeking punch and shear, Erie air hammer, Woodward Powell planer, Cisco-Mueller radial drill, Peerless hack saw, Southwark wheel-press, Ryerson-Rockford sliding head drill, a Lehman lathe, and McCabe spindle lathe.

The four to five million cubic feet of water required annually by the plant is purchased from the Mountain and Plain Irrigation Company. In order to conserve this water supply as much as possible, it is cooled for re-use in a pond at the front of the plant, equipped with four rows of aerators. This pond, together with the broad lawns and trees which are planted at the front, make the grounds very attractive. A long double row of neat garages for the cars of employes has been constructed, and no cars are seen standing about the grounds outside.

Ontario Highway Contracts

Contracts approximating $1,500,000 for the construction of concrete pavement, mixed macadam and traffic-bound macadam, also for tile drainage, surface treatment and for bridges and culverts, are at present under advertisement and were awarded by Hon. George S. Henry, Ontario minister of highways, about the middle of June, according to Assistant Trade Commissioner F. M. Rayburn of Toronto in *Foreign Highway News*. This was the third letting by the department on the provincial highway system during 1929 and raises the total of the contracts awarded this year to $7,500,000. In this third program mixed macadam contracts will run about 25 miles; traffic-bound macadam, 13.2 miles; surface treatment, 150 miles, and tile drainage, 15 miles. Concrete pavement will run 10½ miles, with 15 miles in addition called concrete and mixed macadam alternately. There will be 7 bridge contracts and 4 culverts. The contracts awarded in the first and second lettings this season called for the construction of 102 miles of concrete pavement, 75 miles of mixed macadam, 8.1 miles of grading and 7 bridges. This work, according to the minister's statement, will undoubtedly conclude the pavement program for this year, although other projects are under consideration that are fairly extensive in nature. These projects include several grade-crossing eliminations and one or two large bridges.

Plans for Toronto-Hamilton Highway, Canada

Plans are now being prepared and work will soon commence on construction of a new $150,000 bridge to be constructed at Mimico creek according to Assistant Trade Commissioner L. A. France of Montreal in *Foreign Highway News*. This will be the first step in the projected $2,000,000 development of the Toronto-Hamilton highway between the Humber river and Etobicoke creek.

From Oyster Shell to Commercial Cement

Pacific Portland Cement Company Operates on Marine Deposits Near San Francisco

BY GORDON F. SONDRAKER

HUNDREDS or perhaps thousands of years ago Mrs. Oyster visited the spawning grounds in lower San Francisco bay to deposit her spawn, varying between 100,000 to 10,000,000 in number. Little did she realize that some day enterprising business men would anchor huge dredges over these immense collections of deceased oysters and recover the shells for raw materials to make the cement that, in turn, has become a major ingredient in San Francisco's skyscrapers, roads and other construction work.

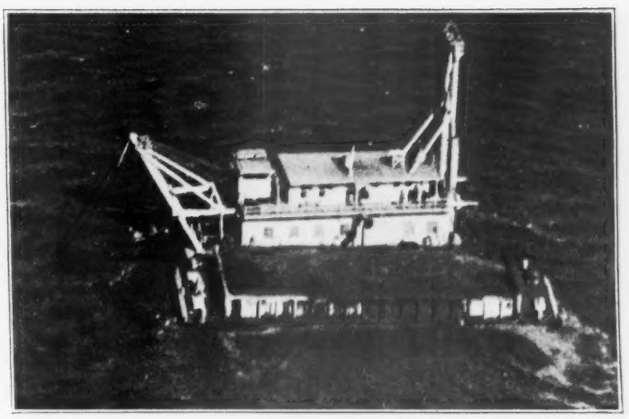


Photo by Geo. E. Russell

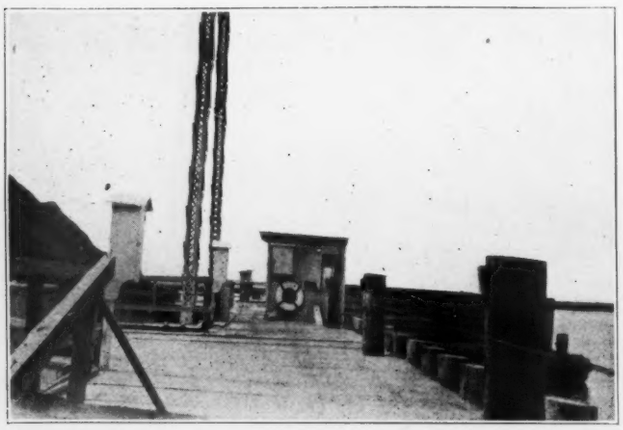
Aeroplane View of Dredge

Near Redwood City on the lower part of San Francisco bay the Pacific Portland Cement Company of San Francisco, California, has built a modern wet-process cement plant. The aforesaid deposits of oyster shells that nature made available furnish the raw materials on which this plant operates. The salt or clay that is intermixed with the oyster shells is in practically correct proportions for a cement raw mix.

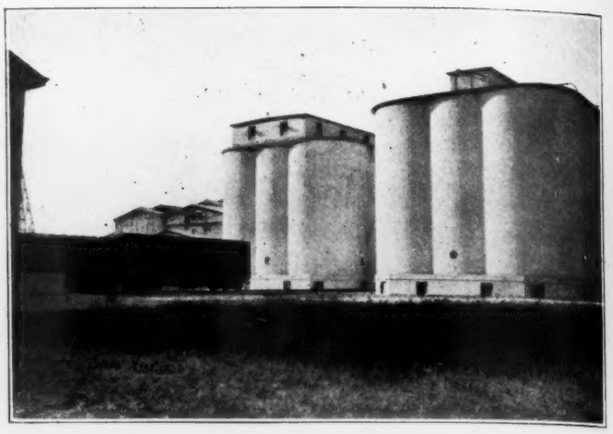
Two dredges, the "Texas" and "Golden Gate" suck up the shells from deposits that are owned by the company. The "Texas" is a Diesel-electric dredge, powered by an Atlas Imperial Diesel engine, while the "Golden Gate" is driven by a Diesel engine without the additional electrical equipment. These dredges pump the shell and silt from the beds into 400-ton capacity barges, ten of which are in service. Each dredge is equipped with 15-in. pumps, thus assuring quick loading of the barges. The tow-boats powered by Fairbanks-Morse engines tow the barges from the oyster beds to the

Photo by Geo. E. Russell

Aeroplane View of Redwood City Plant of Pacific Portland Cement Company



Barge Dock, Showing Air Tugger Housing



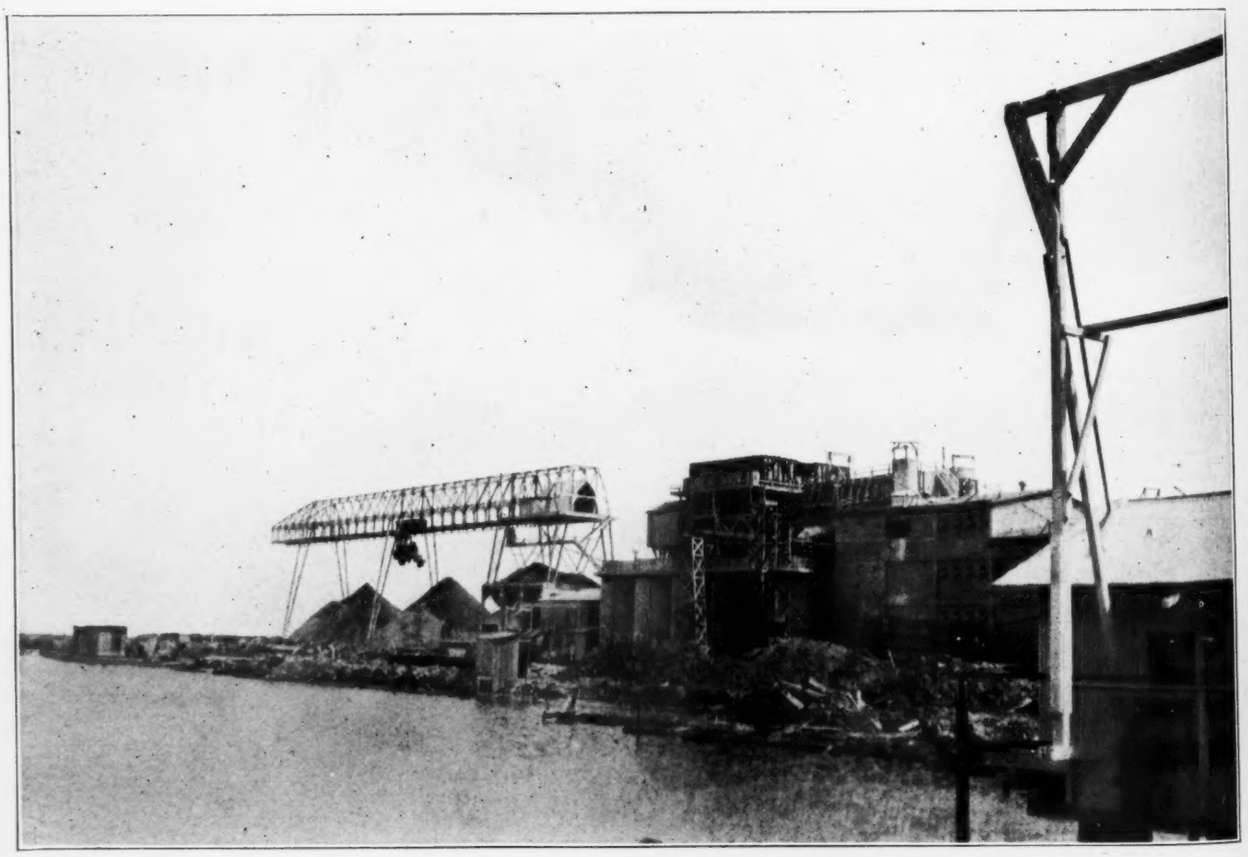
Cement Silos

plant, three to six miles distant, depending on the shell bed that is being worked.

Plant Operations

The barges are unloaded at the plant at a barge dock approximately 800 feet in length. An Ingersoll-Rand air tugger is used for spotting the barges directly under the crane for unloading. A P. & H. overhead traveling electric crane equipped with a 5-yd. Brownhoist bucket unloads the barges and either drops the material in two caisson storage piles holding 5,000 tons each or takes it direct to three steel raw mill bins. As all of the material is under 1 inch in size, no crushing or preliminary grinding is necessary. The shell then goes by an elevator to the raw mills. Some of the shells are also used to make chicken grit. These go first to a Link-Belt scrubber, then to the Link-Belt draining conveyor and to a crusher. The crusher discharges onto a vibrating screen and then to storage. The chicken grit plant will soon be remodeled and two new Link-Belt vibrating screens added.

Screw conveyors driven through Foote speed reducers take the raw material from the bins to the five raw mills. Three of these are Allis-Chalmers 7-ft. by 26-ft. three compartment mills, and two are Traylor 8-ft. by 26-ft. two compartment mills. The material is wet when fed to the mills but enough additional water is added to bring the resulting slurry up to about 40 per cent moisture

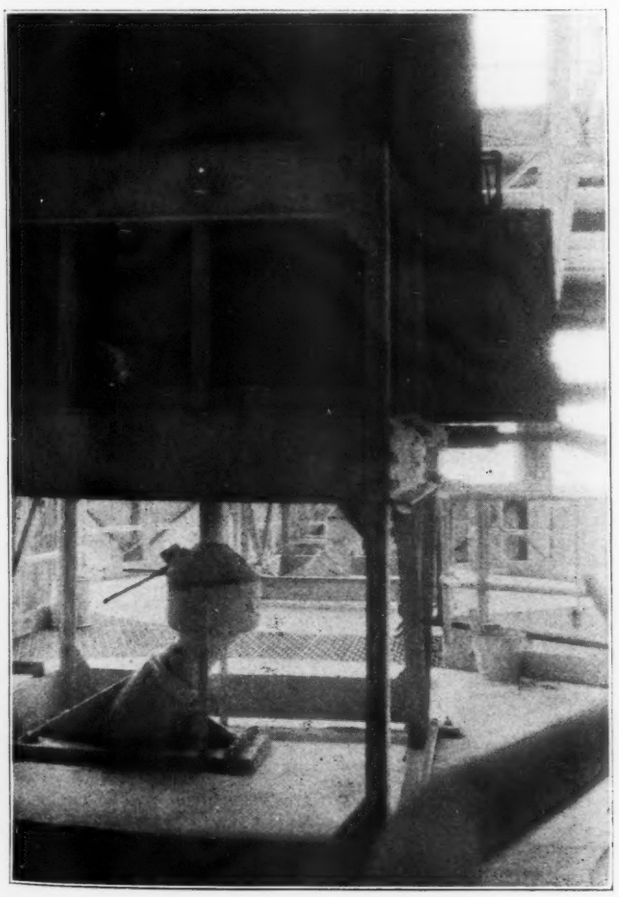


Unloading Equipment, Shell Storage, Slurry Tanks

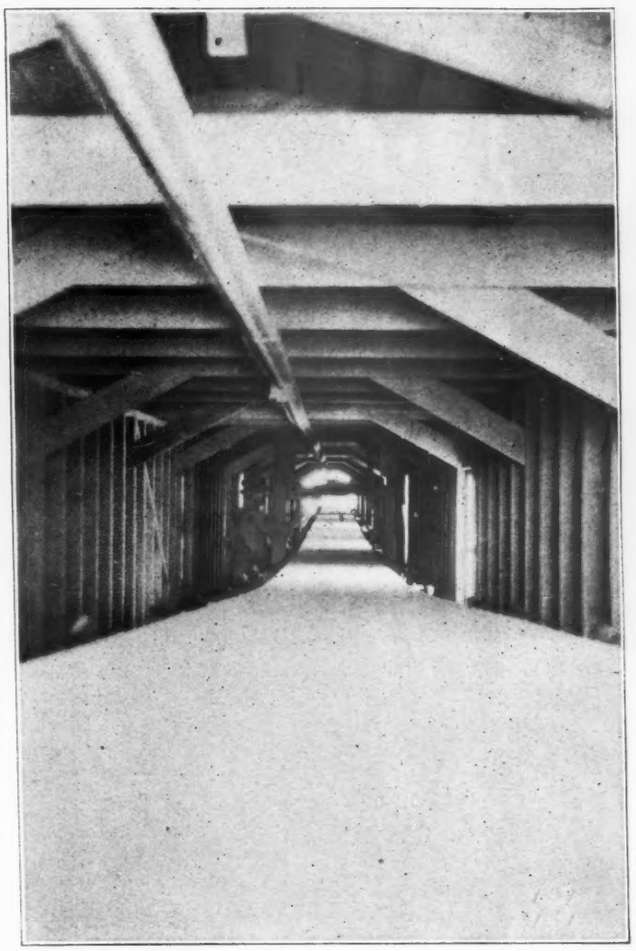
Clinker Elevator and Conveyor

content. Each Allis-Chalmers mill is driven by a 500-hp. Allis-Chalmers motor through Allis-Chalmers magnetic clutches. Each Traylor mill is driven by a General Electric 520-hp. super-synchronous motor.

The slurry from the five raw mills is handled by two 6-in. Wilfley pumps to the slurry tanks. There are seventeen reinforced concrete slurry tanks, four of which are used as kiln feed tanks and the balance for slurry storage and correction tanks. Merco-Nordstrom valves are used exclusively on the slurry lines. The slurry is kept agitated in the tanks by air from five Sullivan air compressors which deliver the air through a distributor equally to the slurry tanks.



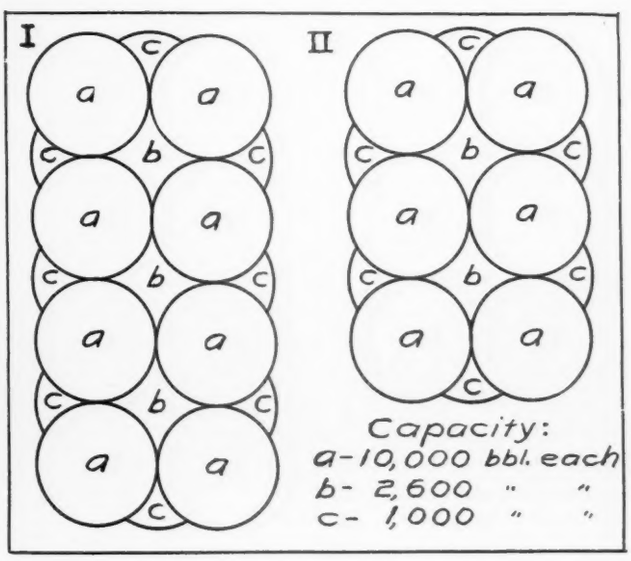
Kiln Feed Tank and Feed Pipe



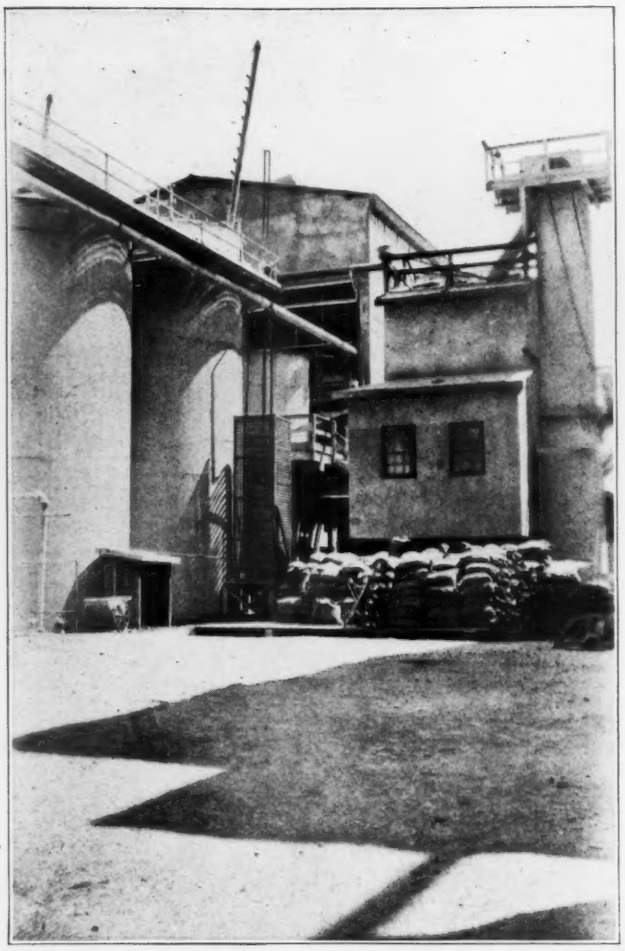
Belt Conveyor, Packing House to Loading Docks

Kilns and Coolers

Wilfley pumps move the slurry from the kiln feed tanks into four steel tanks whence it is taken by rope drive ferris-wheel feeders operated under the same control as that used to regulate the speed of the kiln. This joint control obviates any possibility of either an excess or a shortage of feed to the kiln at any time. Two Allis-Chalmers 10-ft. by



Groups of Silos, Pacific Portland Cement Company



Slurry Tanks and Potash Plant

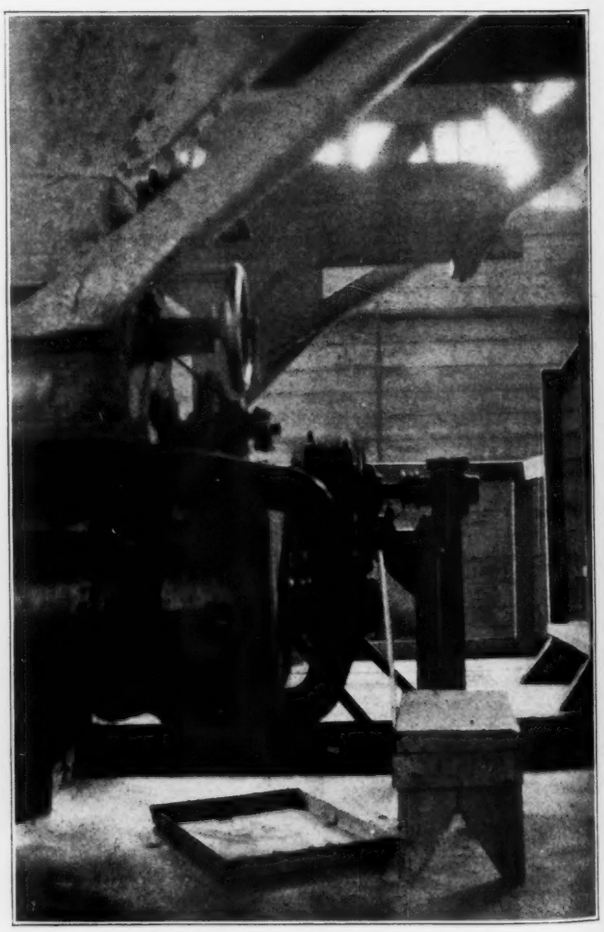
235-ft. and two Traylor 11-ft. by 235-ft. rotary kilns, each operating on four sets of trunnions, are in operation. These kilns have a total daily capacity of 6,000 barrels. The Allis-Chalmers kilns are equipped with one fuel-oil burner each, and the Traylor kilns with two fuel-oil burners each. The oil is pre-heated by a 100-hp. Babcock-Wilcox boiler operating at 160-lb. pressure. Fuel oil is brought in by marine tankers and stored in a reinforced concrete storage tank supported on piling. Air for burning is furnished the kilns by four General Electric centrifugal blowers driven by two 125-hp.

Part of Laboratory

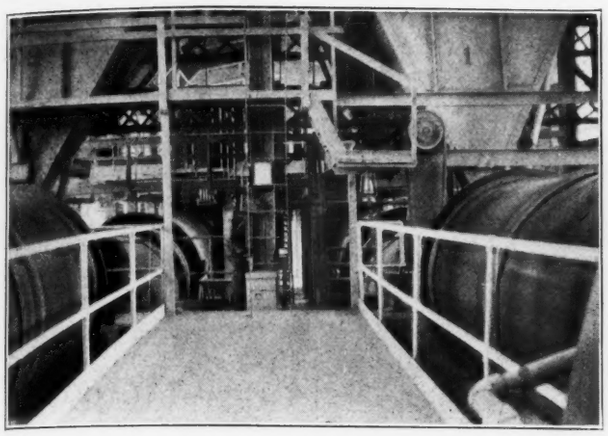
Loading Tracks, Silos, and Office Building

motors through Link-Belt silent chain drives. A Cottrell dust collecting system is installed in conjunction with the single kiln stack that serves all of the kilns. The two fans in this unit are each driven by 200-hp. motors through Link-Belt silent chain drives and Link-Belt drag chains are used. Ellison draft gauges and Brown pyrometers are used in each kiln to insure maximum efficiency of operation.

The clinker discharges from the kilns into two 7-ft. by 60-ft. Allis-Chalmers and two 8-ft. by 60-ft. Traylor rotary coolers. A Link-Belt Peck overlapping pivoted bucket carrier elevates and con-



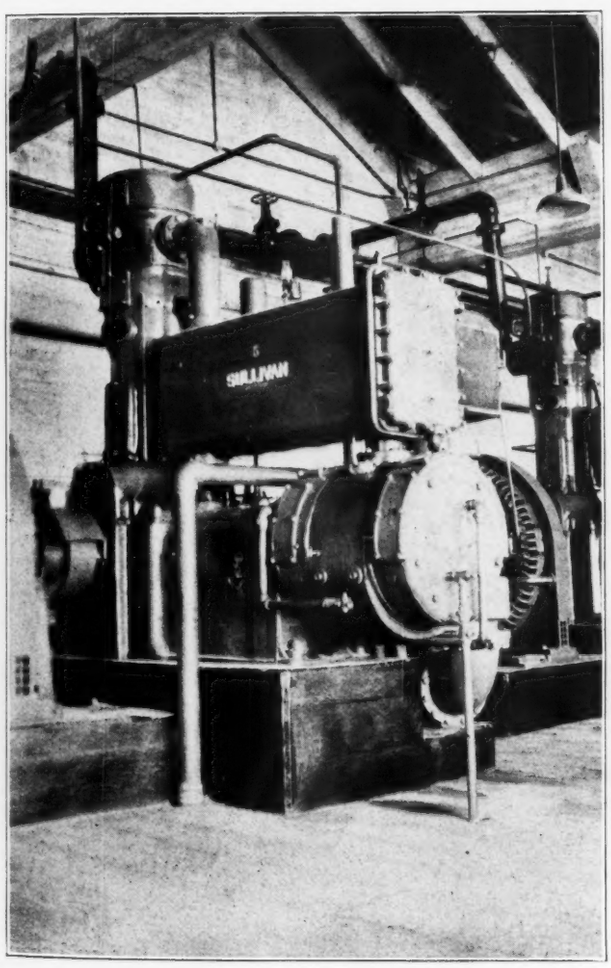
Rocker Feed on Compeb Mills



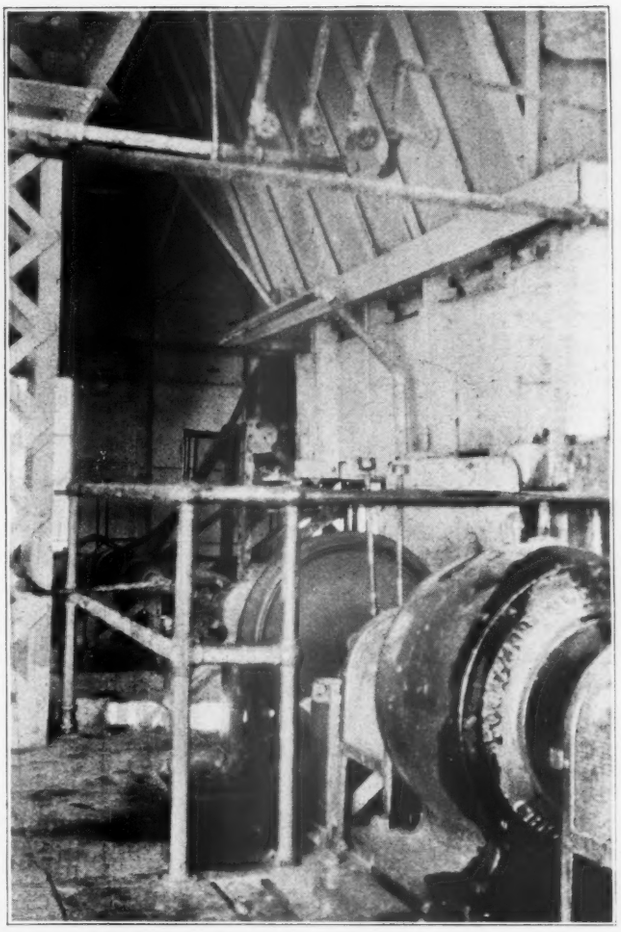
Raw and Finish Mills

veys the clinker either to storage or to the finish mill bins. The same conveyor takes the clinker from storage and to the finish mill bins.

Gypsum is received by rail from the company's property at Garlock, Nevada. It is dumped from the cars into bins whence it is drawn by a belt conveyor to an elevator which, in turn, delivers it to the gypsum bins. A screw-conveyor feeder draws the gypsum from the bins and drops it into the finish mill feeder. This conveyor is variable speed, thus regulating the proportion of gypsum and clinker as desired.



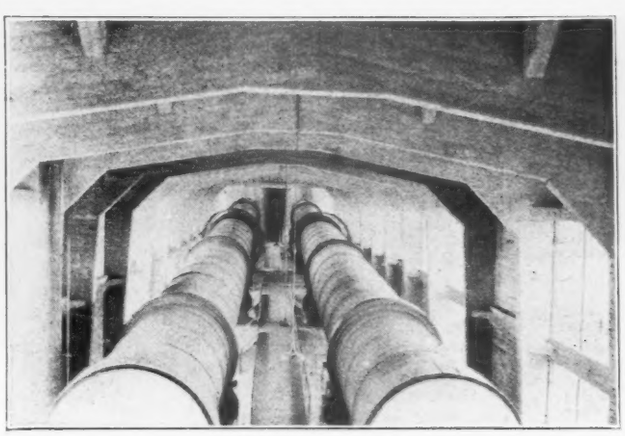
Air Compressor in Redwood City Plant



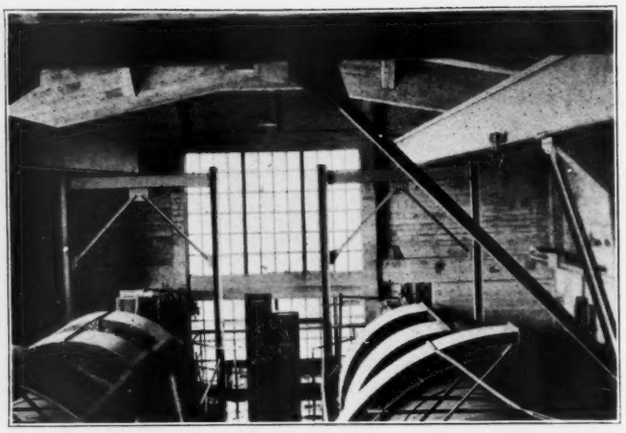
Driving Mechanism for Screw Conveyors Under Raw Mill Feed Bins

Finish Grinding

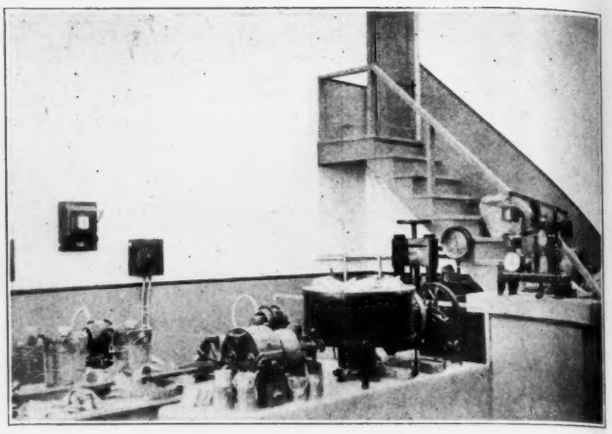
In the finish grinding department two Allis-Chalmers 7-ft. by 26-ft. mills, and two Traylor 8-ft. by 26-ft. mills are used to reduce the clinker to the necessary fineness of the finished cement. Each of the four mills is equipped with a rocker feeder. The Allis-Chalmers mills are each driven by a 500-hp. Allis-Chalmers electric motor through an Allis-Chalmers magnetic clutch. Each Traylor mill is driven by a direct-connected General Electric 650-hp. super-synchronous motor. The finish mills discharge into a screw conveyor which carries



Kilns



Raw Mills



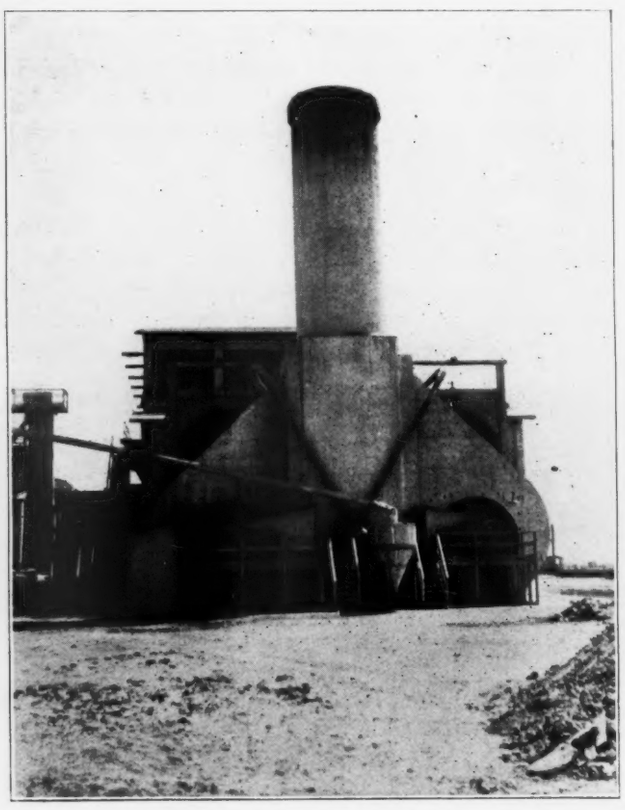
Some of Laboratory Equipment

the ground cement to elevators which in turn deliver the cement to Emerich air separators, there being one such air separator for each mill. These separators classify the ground cement, returning the oversized material to the mill and allowing the cement fine enough to meet the requirements to fall to a bin whence it is taken by two Fuller-Kinyon 6-in. pumps and pumped to the cement storage bins, where it is distributed by a Link-Belt screw conveyor.

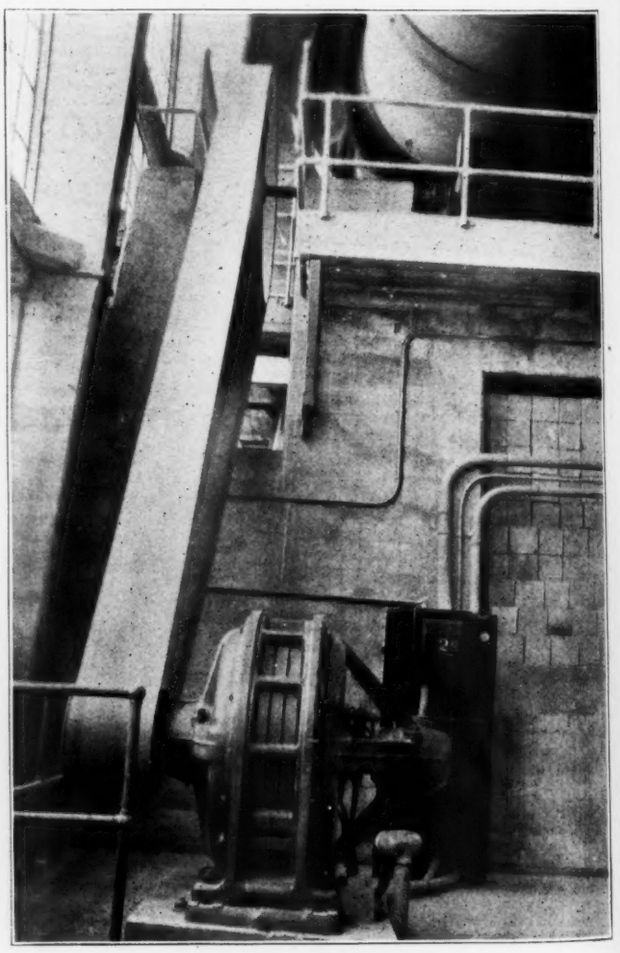
Cement Storage and Shipment

The cement is stored in two groups of silos, the first of which consists of six large reinforced concrete silos holding 10,000 barrels each. Two interstices in this group hold 2,600 barrels each and six small tanks hold 1,000 barrels each. The second cement storage group consists of eight large silos holding 10,000 barrels of cement each, three interstices holding 2,600 barrels each, and eight small tanks holding 1,000 barrels each. One of the large bins in this group is cut up into five sections to hold various batches of special tested cement.

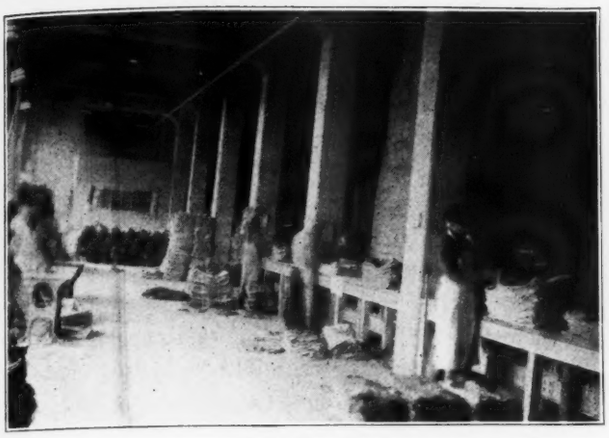
Attention is called to the method used in obtaining the maximum in storage space. As may be seen in the sketch the interstices as well as the exterior triangular spaces that occur in all groups of round tanks set together are in this instance converted into smaller cement silos themselves, thus



Number 2 Dust Precipitator



Kiln Drive

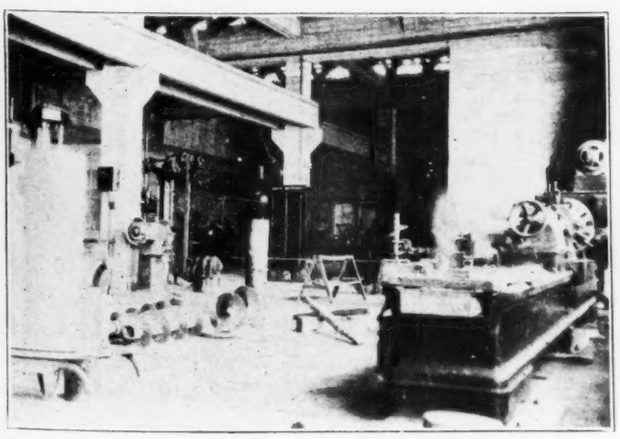


Sack House

not only strengthening the entire structure but increasing the storage capacity by approximately 18 per cent. This allows the operator to carry numerous different small quantities of cement for special testing or other special requirements.

The cement is drawn from the silo and conveyed to bins which feed the eight 3-valve Bates baggers. For rail shipments these bags fall to a belt conveyor which delivers them to the cars where they are stacked for shipment. For water shipment the bags fall to a 36-in. by 1,200 ft. United States Rubber Company Security conveyor belt which runs underground from the packing house until it approaches the dock where it gradually inclines, reaching the ground level at the dock. The bags are automatically counted as they near the dock end of the conveyor. The conveyor is driven by a 20-hp. electric motor through a Foote speed reducer. This conveyor may be reversed so that all unused sacks of cement may be conveyed back to the packing house.

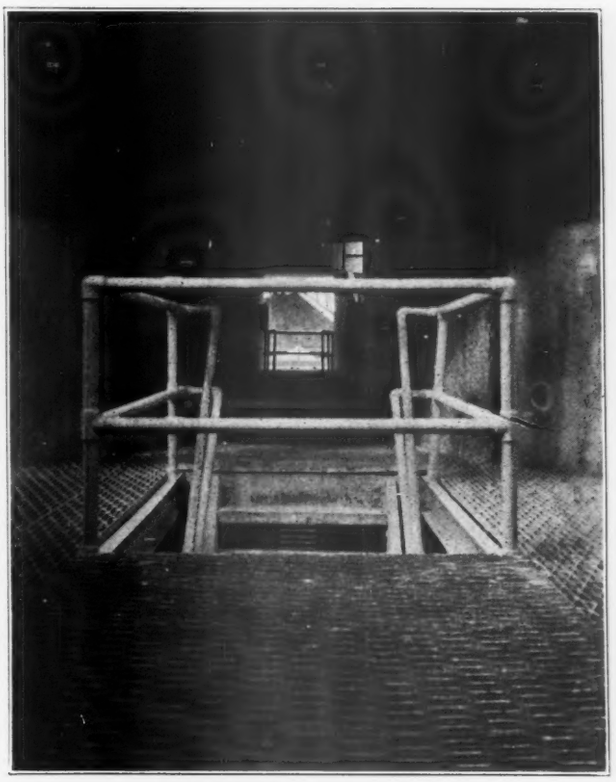
Cement is loaded at the docks into barges for San Francisco bay shipments and into steamers for intercoastal shipment. Two tugs, one dispatch boat, and one small launch comprise the Pacific Portland Cement Company's marine powered equipment. The tugs are used for towing the barges to and from the oyster-shell beds, as previously mentioned. The dispatch boat and the small launch are used for hurried communication between the dredges and the plant as well as for other incidental uses.



Interior, Machine Shop

Miscellaneous

A modern sack cleaning and repairing department is maintained. The bundles of returned sacks are opened and the sacks fed into a Bethlehem tumbling mill which effectively removes the dust. Sly dust collecting equipment is used in conjunction with the mill and throughout the cleaning department to recover dust. As the sacks leave the tumbling mill they are fed onto a belt conveyor where they are sorted out by hand. Those sacks in need of repair are set aside while those fit for immediate use are taken either to the sack house for storage or directly to the sack tiers. Several industrial sewing machines make minor repairs to the sacks. A Bates automatic bag tier closes the bags before being packed. Trackage in and about the plant will hold 60 railroad cars, insuring against car shortage.



Floor Near Top of Slurry Tanks

A complete machine shop is equipped with drills, presses, lathes, milling machines, a case-hardening machine, and a shaper used for making conveyor flights for screw conveyors. Very little repair work is sent to outside shops.

The laboratory is complete in every respect, having not only the customary laboratory equipment but several grinders and crushers, and a Tinius-

(*Continued on page* 63)

How the Portland Cement Association Meets the Problem of Instructing the Builder

By JOHN F. RYAN

WHEN Rip Van Winkle came down out of the hills following his nap, he discovered a number of somewhat bewildering things about life in general. For the world did not stand still during Rip's slumbers, and progress was apparent along a number of different lines.

In a parallel sense, the Rip Van Winkles of a modern building world sometimes boggle along in old and outdated practices for years before they finally wake up to discover that new ideas and practices have completely supplanted the old regime of thought. Knowledge, like time, is a moving and living thing. The accepted truths of today may be the untruths of tomorrow, and it is only by keeping constant check of activity that mankind is able to keep abreast of itself.

Since its inception in 1902, the Portland Cement Association has recognized the fact that time brings change to all things and, more specifically, to structural practices. In an effort to keep itself and the public informed of whatever progress might be made in the study and uses of cement, the Association organized its laboratory research program in 1914. In 1925 it took another forward step in organizing, for public benefit, a series of short instructional courses in the design and control of concrete mixtures.

Concrete is one of the most staple of all building products, and why its manufacture should be a subject for more study might not seem obvious at first to the average builder. The portland cement which goes into the makeup of the concrete is made along fixed lines of manufacture. Aggregates and water are certainly tangible quantities. Why then bother about changing mixture formulae when apparently workable systems of proportioning are already known?

Perhaps the only direct answer to such a question is to offer a suggestion in passing that the questioner investigate for himself the proved superiority of concrete made under precise modern methods as contrasted with some of the concrete made by the rapidly disappearing methods of fixed proportion. It may be a trifle startling to some to discover that methods of making concrete have been practically revolutionized in the last twelve years. The rule of thumb is definitely out of the picture today, and has been supplanted by concise and authenticated information which must be applied to the individual case.

Concrete is unique among the building materials. Unlike all others, it is brought to the construction job in its elemental state and must be combined on the site to bring about its final form. This fact places responsibility for quality of the finished product largely upon the field forces. It is therefore vital that the contractor, engineer and architect understand the technology as well as the mechanics of concrete making.

Water-Cement Ratio Law

Now, a laboratory does a number of things besides test materials. One of its main duties is to compile its test observations in some form which may be applicable to the situation in hand. In 1918, after four years of constant effort, the Portland Cement Association research laboratory announced that it had evolved a proportioning formula with which the strength of a given batch of concrete could be predetermined. The laboratory stated that regardless of the amounts of aggregate used in the mix, the potential strength of the resulting concrete varied inversely with the amount of mixing water used. This principle was termed the water-cement ratio law by Prof. D. A. Abrams, who was in charge of these tests. It applies to the proportioning only, and assumes that suitable materials and power methods of manufacture will be used.

The next step in the process was to hit upon the best available method of broadcasting the practical application of this information to the building public. The Portland Cement Association short courses in the design and control of concrete mixtures were organized to fulfill this requirement and to meet a sincere demand from the public itself for technical and practical knowledge.

Short Courses in Concrete Design

The first course was given at Birmingham, Alabama, on May 1, 1925. Thirty men were expected, 130 attended. During the ensuing four years, to May 1 of the present year, 37,847 persons have been registered in this educational work throughout the United States and Canada. Up to the present time, 260 P. C. A. supervised courses have been given in practically as many cities.

Such a statement in regard to attendance might mean little under ordinary circumstances, but an analysis of the professional character of the students themselves evolves a number of interesting things. In the first place, the men who have attended P. C. A. courses key in almost exactly with the three most important professional groups en-

gaged in the building field—the engineers, the contractors and the architects.

Of almost equal interest is the fact that those who have attended represent practically every building category, from the two-barrel job to the trainload class. The prominent fact to remember then is that P. C. A. instruction is getting into the places where it can be expected to do the most public good.

A third interesting consideration of the students is in their age classifications. Not all of the learners are young fellows by any manner of means. Old and grizzled structural heads are bending to the task of learning new methods. It is also important to remember that these are the men who have "been through the mill" of the building game. These are the men who have used the old proportioning methods for years until they have come to the realization that something more definite and practical has come into the scheme of things concrete in the past decade.

The type of demand precludes the possibility of the courses becoming too set in their scope. As new research material is made available for use, changes are made in instructional data to conform to new requirements. The courses are designed to keep abreast at all times of the developments of the research staff, and of improvements in the application of these principles in construction. As such they are among the most "alive" of all short study programs. Material information must not be allowed to stagnate if the instructional body and students are to derive any practical benefit from their study.

Request from Educational Institutions

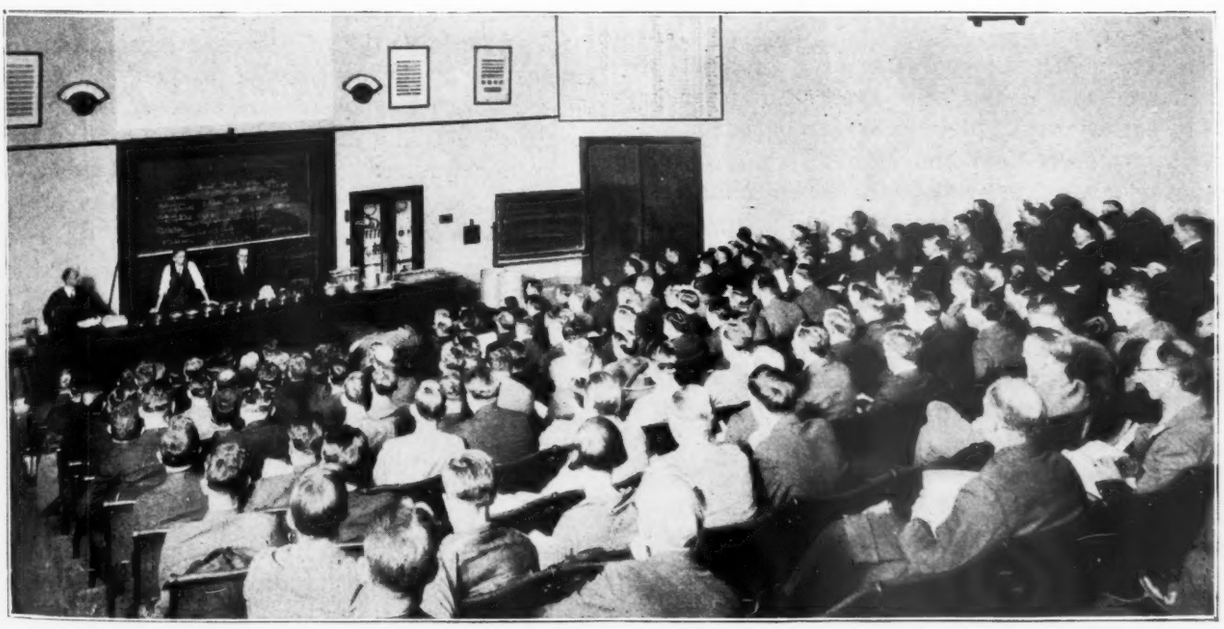
From a psychological standpoint, it is interesting to note that the demand for educational material is coming from outside the association. This force is manifesting itself in requests for course plans and instructional material from an annually increasing number of educational institutions.

The demand of student engineers for instruction in the proper methods of handling concrete has reacted to cause engineering schools and educators to seek essential instruction from the Portland Cement Association. It is significant from an educational standpoint that a number of colleges have adopted courses in concrete mixture design as a standard portion of the curriculum. In most cases these schools have requested up-to-date text material from the association.

To further accommodate this demand from the schools, the association has organized an annual conference series for the benefit of instructors. In three years, 50 colleges in 30 states have sent 71 representatives to attend. Concrete materials and laboratory subjects, design and control, technical research, and general informational material form the basis for study.

Recognizing the need for adult education in a subject of such importance, and having observed the success of hundreds of P. C. A. short courses, numerous colleges have entered the concrete field as an extension activity.

The extent of this work in the collegiate field might be briefly summarized in the statement that 58 colleges have sponsored 80 short courses conducted for the public by P. C. A. representatives, and that 19 colleges have participated in or have given 72 extension courses. In addition to those otherwise listed, fourteen more schools are planning to hold future courses in concrete design and control.



Teaching the New Idea.
Class Conducted by the Portland Cement Association Learns the "Why" and "How" of Making Good Concrete.

Simple Ideas Promulgated

Too many cooks spoil the broth, and likewise, too many precautions may ruin a perfectly good concrete job. The essential theory behind all educational work of the P. C. A. is that the best concrete may be obtained through the exercise of simple precautions. The man who is to supervise the batcher will have no time for the consideration of a slide rule or complex mathematical charts. The rule must be workable with a minimum of fuss and bother. The water-cement ratio law is the child of a laboratory, but its application is simple enough to meet any given set of field conditions. Instructional work is carried out with the idea in mind that the work must be practical.

The courses have been outlined and are administered in such a manner that the concrete worker may understand with a minimum of technical effort. Specialists who desire a more complete technical background for their study are accommodated by laboratory courses designed to suit their needs.

The usual lecture-demonstration course is given on either two or three succeeding evenings. Fundamental requirements of concrete are first considered, showing in final analysis that its quality is a function of proper proportioning combined with effective field methods. The fundamental law of proportioning, that strength and durability are related to water content per sack of cement, is explained and its application demonstrated by actual batches of concrete.

Conclusions are drawn from past practice showing how certain changes in proportions affect the quality, workability, or cost of concrete. Proper methods of selecting materials, measuring, mixing, transporting, placing, and curing of concrete are considered.

In concluding the course, special problems are considered and discussed. These usually include cold-weather work, high early strength concrete, use of waterproofers and admixtures, and other topics of general interest to the concrete builder.

The laboratory course is usually completed in six sessions and is a more intensive type of training. While it is sometimes combined with the lecture-demonstration course, it is more often offered as a follow-up for men who want first hand experience under a competent instructor. Laboratory classes are usually limited to twenty or thirty so that individual instruction may be given.

No fee is charged for any course of instruction given entirely by the P. C. A. A fee is usually charged for courses conducted by colleges to cover the cost of materials, use of equipment, and the time of the instructor. During the course, each man has opportunity to make the usual measurements and tests on materials, proportion batches by trial, make slump tests, make and break test cylinders and perhaps try out his own ideas as to materials and proportioning.

Courses Have Proved Popular

Educational work in some degree is a matter of cut and try. If the matter to be presented meets with student favor there is an immediate clamor for more. This is one of the almost predestined conclusions about the P. C. A. courses. In almost every course given to date classes have held more students than were expected to register. With a course once given there has always been a subsequent request for its repetition. These facts speak well for the type of subject matter given and the manner of its presentation.

Perhaps one of the greatest things accomplished by the work is that old ideas of concrete, wherein certain arbitrary proportions were used, are being supplanted in the mind of the building public with modern ways of thinking. In the past it has been customary to conceive of concrete as something produced by taking a mass of aggregate and cement, mixed and made workable by water. The water, in this mental scheme of things, played no other part than that of regulating workability. Educational work of the P. C. A. is bringing about a reversal of this thought, and states its concept briefly as follows: concrete is made by preparing a batch of cement paste, of fixed water ratio, in which aggregates are embedded. Once the desired proportions are established, the procedure is the same as heretofore except that all materials, including water, are more accurately measured. This statement of principle was the basis under which the educational program was originally established, and its further applications constitute a major portion of the study work.

Students are taught that exercise of proper control methods do not of necessity mean an increase in costs or a slowing down of production. Through practical work they are shown that control generally results in a saving, either on actual job costs or in maintenance over a long period of time. Once grasped and put in effect, control of the right sort requires no more working time than the old system.

Research Projects

Research of the laboratory has not ceased with the establishment of the water-cement ratio law. For example, the problem of obtaining color in concrete by combining pigments with the cement mortar has been a matter for considerable study.

Researches into uses and types of aggregates and the chemical constituents of various mixing waters have been undertaken along with a vast array of other projects all relating to the composition and uses of concrete. Incidentally, the association's sand library, containing specimens from the

(*Continued on page* 63)

Theoretical and Practical Considerations Concerning Spontaneous Firing of Coal During Storage

BY A. J. HOSKIN

ALTHOUGH coal is not used nearly so generally in the non-metallic industries as it was in earlier years, and there is prospect of some decline in its consumption in the future, there are many operators who depend wholly upon this fuel for the local generation of their power requirements. And, in the cement industry, even when coal is not consumed in generating power, it is in steady demand, at many plants, as a fuel for the kilns. Notwithstanding the competition, in this function, of oil and gas, coal will probably continue an important item of supply in such plants for years to come. Irrespective of whether it be burned in its crude form on grates or in its pulverized form through burners, operators will probably continue to maintain storage piles of the raw material.

The coal that is used in this cement industry is bituminous of some grade. Ever since its first practical consumption, shippers, dealers, and users have had occasional trouble from the spontaneous ignition of this fuel. Such fires are no respecters of owners, and cement companies have been hosts to these phenomena, although much less frequently, no doubt than have operators in other industries who have been obliged to carry much larger stocks of coal in storage—as railroad and public-utility companies.

Outdoor Storage Most Common

Coal is stored at plants by almost every scheme that is followed in manually and mechanically handling other crude materials. It is not possible to classify storage systems because, really, no two operators practice exactly like systems, but it may be said with assurance that, by a wide margin, the bulk of coal storage is out-of-doors. Shovels, wheelbarrows, horse scrapers, dumping trucks, or portable elevators are employed in smaller operations, while draglines, ditchers, spreaders, belt conveyors, various types of cranes, cableways, aerial trams, and swinging bridges are used in larger plants. Any plant boss is free to devise his own scheme, but he may be guided by the experience of others, especially with regard to the fire hazards.

Within the past few years much has been learned concerning spontaneous firing in stored coal, but investigators admit that there is still much to be learned. However, sufficient facts have been collected to explain all of the conditions that attend these occurrences, and theories have been propounded to fit these circumstances. The following discussion is an attempt to present these scientific deductions in a few words for the benefit of operators who find it expedient to stock coal on their premises. By duly considering these theories, the plant manager and every employee who has the handling of coal into and from storage, will become cautious and he will endeavor to avoid any practice that appears to offer a hazard.

Simple Oxidation

The natural heating of coal is due to the oxidation of its combustible components. Soft or bituminous coal exposed to ordinary atmosphere absorbs more or less oxygen at all times, and such a combination of the constituents of the coal with oxygen is accompanied by the generation of heat—precisely as in the case of the intentional burning of the coal. It is believed that the first step in this process creates neither the monoxide nor the dioxide of carbon, but rather a somewhat unstable absorption or adsorption that prepares for the following step, the true oxidation of the generation of the oxides of carbon. Both steps are attended by heating.

When this occurs in the open air, we call the reaction weathering which is recognized, not by any sensible rise in temperature, but by the resulting deterioration of the coal. The coal loses its lustre and perhaps crumbles or slacks, the attending heat being dispersed by wind. But within a pile of coal, where heat cannot escape as rapidly as it is generated, there is no alternative than a steady rise in temperature. Regardless of whether the oxygen for further reaction were stored previously with the coal itself or be derived now by diffusion through the voids of the pile, the temperature proceeds to rise.

Ventilation of Coal Piles

If there be no accessions of new air to the heating spot, the temperature rise cannot become serious, and this is the usual condition. However if air be replenished at a rate to maintain oxidation—even slowly—the temperature must rise if the heat cannot escape. A mass of coal acts as a high-grade insulation against the travel of heat. Hence a spot that is protected by several feet of fine coal may ultimately attain incandescence which will promptly change to real combustion if air be available even most slowly.

Ventilation, then, is a function of spontaneous firing. Coal is absolutely safe during storage if it receives no air at all within the mass of the pile or if it secures an abundance of air in circulation. In the first condition, no heat can be generated; in the

second condition, the generated heat is promptly removed. Both schemes have been tried repeatedly and seem impractical. Attempts have been made to provide coal piles with ample porosity to attain the second condition of safety, but the practices have been discarded. Extra time and expense are involved in placing the piping, flues or conduits that provide the circulation of air, as well as in removing such equipment when the coal is reclaimed. It would seem, nevertheless, that engineering talent will yet devise an inexpensive, practical scheme for the adequate ventilation of coal piles.

Coal is safe in a steel or other hermetic bin or silo but, in practice, absolute exclusion of air is impossible except at unwarranted expense.

Exclusion of Air from Coal Piles

Success has been met in storing coal out of doors by practices which aim at both avoidance of air placed with the coal and the sealing of the exterior surfaces of the piles. One company unloads its coal from railroad gondolas with a locomotive crane. The bucketfuls are dropped in rows on the ground, forming small mounds. While the crane is waiting during the switching of cars, the clamshell bucket is detached and is replaced by a home-made 2½-ton steel-and-concrete weight having a broad flat bottom, and this is hoisted several feet and dropped upon the mounds of coal with a compression that is truly remarkable, effectively closing much of the void space in the mass.

Another company also uses a clamshell crane and builds irregular mounds of coal but these are leveled by a drag drawn by a caterpillar tractor, after which the drag is replaced by a heavy roller.

Still another company uses a stationary swinging clamshell crane to unload the railroad cars and to dump the coal onto a single heap beyond a concrete wall which separates the trackage from the storage plot. From this heap the coal is spread radially, by a dragline bucket, into a fan-shaped pile of large ground dimensions. As finished by the dragline, each layer is about 17 inches in thickness. The bucket is then replaced in the dragline by a two-ton roller which compresses the layer to about 13 inches, thus indicating the expulsion of approximately two-thirds of the air originally in the screeningcs.

In some plants the successive thin layers of coal are tamped manually. In any case, it is desirable to render the uppermost layer of the coal pile as smooth and compact as possible.

The Influence of Pyrite

Many persons have attributed coal-pile fires to the sulphur content. Pyrite will oxidize and with the generation of heat. A sulphurous odor may emanate from a pile of aerating coal before any odor of "coal-gas" is noted. But investigations tend to exonerate sulphur almost completely. Although it is objectionable in some respects as a constituent of coal, its tendency to oxidize is not so great as, while its contribution of heat units is little different from that of the bituminous components of the coal. It can be held guilty to the extent that, when it does oxidize, it expands and thereby aids in the disintegration or degradation of adjacent bits of coal.

The Question of Moisture

It is difficult to account satisfactorily for certain coal-pile fires except upon the basis that they were related intimately to certain moisture conditions. Water is present in various forms, in every outdoor storage of coal. It is an inherent constituent of the very substance of the coal genetically, and is known as structural water. Also it is held within the cleavages, fractures and other interstices, as free moisture. Again water is added to and evaporated from stocks of coal by alternations in weather. We thus see that, in addition to simple oxidation, there is hydration of coal during its storage.

It has been proved that heat is generated by wetting coal after it has lost some of its inherent water, the amount of such heat depending upon the relative deficiency in this form of water. Although this phenomenon is not to be explained similarly, it can be likened popularly to the reaction when water is applied to quicklime or gypsum. Even if climatic moisture does not actually function in generating heat, it may so saturate a coal pile as to stifle the circulation of air and thus prevent the dissipation of heat that is generated. On the whole there is doubt whether or not water can be charged with any significance in the rate at which a coal pile may heat.

Inherent Gas

Coal, either in place underground, or during its mining, transport, and storage, exudes a natural gas that is really part of the so-called volatile combustible. Its rate of emission diminishes with the weathering of the coal, so that well-seasoned coal is nearly destitute of such gas. A mass of coal seldom fires if it survive the early period of storage when it liberates most of this highly volatile component. We can believe that any mass of coal that has heated to a dangerous temperature and has then cooled naturally is thereafter immune from autogenous heating. Upon this basis it is rational to theorize that the primary oxidizing reaction may be with the combustible gaseous component rather than with the solid carboniferous substance of the coal. Coal that has undergone intermediate storage—as during transit or by dealers—seldom gives trouble during its final storage.

Carbon-Dioxide's Part

An affinity is known to prevail between coal and

carbon-dioxide; and some recent investigators believe that spontaneous heating in coal is due, in part at least, to a reaction between the solid part of the coal and this gas that results from its own oxidation. The coal absorbs this gas greedily and with the generation of heat much greater than when it unites with straight oxygen. For a long time it was popularly assumed that CO_2 would serve as a quenching medium but this now appears to have been a wrong theory. Of course both oxidation and the absorption of carbon-dioxide must soon cease if oxygen be wholly excluded.

Contacts Between Unlike Coals

A pile of coal should never be built of shipments coming from different mines, nor at different times from a single mine. Fires have occurred in piles composed of carloads of mine-run stored in contact with carloads of screenings from the same mine. In all such cases the unlike coals have differing characteristics, and one of the coals may serve as dry kindling to be ignited by heat generated in the other coal.

Miscellaneous Hazards

A foreign substance in a coal pile should be viewed with special concern, especially any substance that is combustible, such as chips or splinters of wood, twigs or leaves from trees, scraps of paper or rags, garbage, weeds, hay, straw, horse manure or even remnants of a previous storage. Such substances will provide the tinder that will take fire from the heat generated in the coal and they will thus quickly ignite the pile.

Piles should never be built against board fences. Fires have been attributed to steel structures that have been embedded in coal piles, upon the theory that the metal conducted heat into the pile from either the sun's rays or from neighboring buildings. Pipes containing hot water or steam should not be close to coal piles, nor should a pile be built above a conduit or sewer that may contain warm fluids.

The foregoing is an exceedingly brief synopsis of a big subject. Many phases have not been touched. This fact of spontaneous combustion in stored coal has furnished much discussion among large consumers of coal and it should therefore be a matter of concern among cement operators who burn it in large quantities. By duly putting to practical application the few suggestions given herein, operators may feel reasonably assured against any unwelcome so-called spontaneous fires in their outdoor piles of coal.

Crushed Stone Directors To Hold Meeting

A meeting of the Board of Directors of the National Crushed Stone Association has been called for July 26 and 27. It will be held in the Ambassador Hotel, Atlantic City, and convenes at 10:00 a. m.

Meeting the Problem of Instruction

(*Continued from page* 55)

four corners of the earth, is perhaps one of the most complete of its kind in the world.

As further findings of the laboratory are made available, this material is put into usable form for educational work of all types. The United States Bureau of Standards and other independent bodies which engage in the same fields of research lend and find much cooperative assistance with the P. C. A. Through its central office in Chicago and through the 32 branch offices scattered all over the nation, the educational work is administered by a staff of especially trained experts and educators. Not all of their time is devoted to presenting course work however, for they are also available for first-hand attack on perplexing field problems. If the solution of a problem is beyond the skill of a field engineer, a laboratory man is assigned to the task.

All this business of going to school again may seem to be more or less balderdash to the man on the job who is interested chiefly in getting quantity production, but the courses have been so arranged that this same man on the job may comprehend his findings without excessive mental sweat or bother. The competent workman knows the value of keeping his tools in condition, and he also knows that new tools sometimes achieve better results than old ones. Through the short courses of the P. C. A., new tools and instructions for using them are placed in the builder's hands in clear and simple form for immediate use.

Pacific Portland Cement

(*Continued from Page* 57)

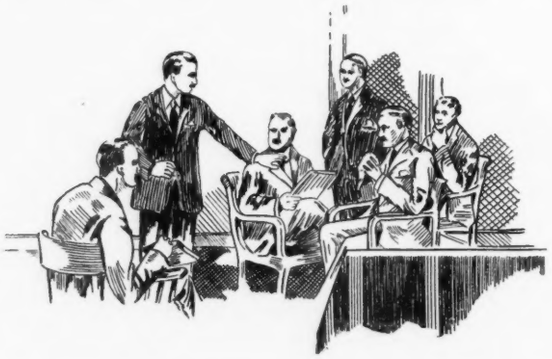
Olson compression testing machine. The laboratory is under the able direction of O. D. Small, chief chemist.

Some interesting engineering problems were encountered when the plant was first built as all of the land was then a tidal flat incapable of supporting the weight of the buildings and machinery. It was necessary to sink a considerable number of piling before any of the buildings could be erected. The present steamer channel was also dredged by the company, as well as the water front adjoining the barge dock.

Officers, etc.

The Pacific Portland Cement Company operates another cement plant at San Juan, California; a quarry near Auburn, California; and two gypsum and plaster mills, one at Garlock, Nevada, and the other at Plaster City, California. The company officers are: Robt. B. Henderson, president; J. A. McCarthy, vice-president and general manager; J. H. Colton, vice-president in charge of operations, and Harry T. Battelle, secretary, all of San Francisco. M. J. Johnsson is superintendent of the Redwood City plant.

Discussing PRACTICAL Problems



Successful Lubrication

RESEARCH work on lubrication has become a problem for learned and highly specialized engineers. This has brought to light a tremendous number of new facts. The lubrication problem is presented to the operating men of the Pit and Quarry industries for their consideration in order that we may conduct a discussion on this important subject from every angle.

Here is Your Chance

Here is the opportunity for which you have been looking. Many of you have suggested an open forum for airing the views of practical men. Some of you have views of value to your neighbor, all of you have questions to be answered. This is being done at the request of readers and now is the opportunity for readers to avail themselves of the opportunity to help themselves and others. Give us your opinion or mail in a question that you wish to have discussed.

PIT AND QUARRY

Operating men and engineers study lubrication for the purpose of learning the best method of preventing the wearing away of metallic surfaces which have motion relative to one another. There are two general classes of lubrication. These are known either as boundary or solid film lubrication and viscous or fluid film lubrication. Our problems deal with the practical side of both systems. It is well to save money by not wasting the oil in a prodigal manner. We should not use the oil in such a fashion that it means a greater loss by the depreciation of machinery.

Correct lubrication is a form of production insurance and is essentially a branch of industrial economics. It is a means for reducing power waste and friction to the minimum, insuring the life of the machinery and obtaining a more desirable quality of product. An efficient lubricant, when properly functioning, eliminates solid friction and replaces it entirely with fluid or solid film friction.

The relationship between lubrication and power losses is not theoretical only. It is a fact that has been demonstrated and admitted by every authority in our field. In addition it should be studied in its relation to the life of the machine, replacement of parts, repairs, value of machine production, safety to the worker, fire hazards and cleanliness of product.

Owners, superintendents, foremen, machinists and many others engaged in the Pit and Quarry field are anxious to know how YOU save money by properly applying lubrication at the right time, in the right way, of the proper content and just a sufficient quantity.

Answers to this problem should be written in your own way, whether with typewriter or lead pencil and should tell us just what YOU are doing at your plant. All employees and operators in the field are invited to participate in these discussions. Letters on this subject will be published in the July 31 issue of PIT AND QUARRY and should be received in the office not later than July 20. For each answer published, PIT AND QUARRY will pay not less than $3.

What is Your Method?

1. *What system of oil distribution have you found most effective?*

2. *How do you insure adequate supply of lubrication to your equipment?*

3. *Do central greasing stations solve the problem of lubricating your locomotives, cars and trucks?*

4. *How do you lubricate shovels, cranes, draglines, conveyors, crushers, screens and other permanently located bearings?*

5. *How do you store the oil for each distribution?*

6. *Upon what bearings do you use pressure lubrication?*

All operators, superintendents, foremen, electrical and mechanical men or those who have had actual practical experience are urged to discuss this question for which acceptable letters will be paid as stated. YOU are invited to submit YOUR problems for discussion.

NON-METALLIC TRAFFIC PROBLEMS

Conducted by M. S. Allison

Carload Weights

The American Railway Association, Car Service Division, special commodity loading statement for the year 1928, shows the average number of *tons* per car as follows:

	Tons
Gravel and sand (other than glass or moulding)	53.3
Stone, broken, ground or crushed	53.0
Cement, National or Portland, building	38.0
Artificial stone, N. O. S.	29.7
Lime, common (quick or slaked)	22.6
Furnace slag	52.8

Grand total—all carload traffic:

	Tons
1928	35.0
1927	35.1
1926	35.1
1925	34.4
1924	34.0
1923	34.5

Novel Plan

A novel plan for the purpose of disposing of differences between shippers and carriers was recently used by the Interstate Commerce Commission in a number of cases involving freight rates on sand, gravel and crushed stone to destinations in southern Illinois, covered by Docket No. 21939 et al.

Owing to the conflict of interest among the producers competing for business in the destination territory involved, and likewise the carriers' interest in protecting their revenues, it was apparent that a lengthy hearing and voluminous record would be involved.

The Interstate Commerce Commission has found itself burdened with large records made in many freight rate proceedings and with view of avoiding same in this instance and with further view of experimenting towards a method to shorten proceedings before it, suggested that a conference plan be used.

Under such a plan conferences are held by the interested parties and as many as possible of the facts are agreed upon. Prepared statements relating to such facts as plant capacities, transportation conditions and rate histories can be often agreed upon and submitted as evidence.

At the conclusion of the hearings most of the parties expressed opinions favorable to the conference plan.

Examiners Proposed Extension of Present Scale on Cement Rates

Examiners for the Interstate Commerce Commission have recommended to that body that they find the present rates on cement from Humboldt and Chanute, Kansas and Ada and Dewey, Oklahoma, to various points in the southwestern part of Texas, to be unreasonable.

They suggest that the scope of Scale IV, now applicable from the points involved, also other producing points to other portions of Texas, be extended to include as destination territory points in southwestern Texas.

It will be some time before the interstate Commerce Commission announces its decision in the matter, which is covered by their Dockets numbers 20821, 21164, 21958.

Southwest Sand, Gravel, Etc., Adjustment

The Interstate Commerce Commission has given its decision in the so-called "Hoch-Smith Southwestern Sand Case" (Docket 17000, part 11).

As a result the carriers are required to establish, not later than October 17th, 1929, a new mileage scale of rates on sand (except silica and asbestos), gravel, crushed stone, etc., throughout the Southwestern territory.

The shippers contended, among other things, that the Hoch-Smith resolution passed by Congress some time ago justified lower rates. The carriers pleaded that the same resolution justified still higher rates owing to orders issued by the Interstate Commerce Commission requiring reduced rates on certain farm products. Apparently the Commission gave greater weight to the long established theory of what the traffic can or will bear.

The carriers contended that the new rates should bear a fixed relationship to the published first class rates, it being their position that the rates should be fixed at 9½ per cent of the first class rates. The shippers successfully contended that it is not proper to base rates on heavy loading commodities moving in open top cars on the rates made primarily to move merchandise traffic.

The following illustrates the new scale:

Distance, Miles	For Single Line Hauls	For Joint Line Hauls	Spread
10	.50	.65	.15
50	.74	.89	.15
100	1.00	1.15	.15
150	1.25	1.40	.15
200	1.50	1.60	.10
260	1.70	1.80	.10
350	2.00	2.05	.05
500	2.50	2.50	..
650	3.00	3.00	..
800	3.50	3.50	..

The Commission states that, in addition to being reasonable maximum rates, the new rates will remove existing prejudicial and discriminatory situations.

Pacific Coast Aggregates to Classify Stock

The Pacific Coast Aggregates, Inc., formerly known as Pacific Aggregate, Inc., which was formed several months ago to consolidate 16 rock, gravel and fuel companies of California, including Pratt Rock & Gravel Company, Pratt Building Material Company, California Building Material Company, Acme Gravel Company, American River Sand & Gravel Company, and California Rock Company, is authorized by corporation commission to reclassify its stock and provide for various conversions. Original capitalization was 300,000 shares of class A and 900,000 shares of class B stock.

Under the reclassification the capitaliziation will consist of 400,000 shares of no par value preferred and 565,000 shares no par common. The company is authorized to issue 20 convertible preferred shares to class A stockholders for same number outstanding and to issue 200,000 shares of convertible preferred to holders of first mortgage 6½ per cent bonds as bond brokers convert the bonds, also to issue 60,000 shares convertible of preferred and 15,000 shares of common to holders of 10 years 7 per cent convertible debentures and 380,020 shares of common to holders of convertible preferred. This issue of common will take care of all preferred stock to be issued in exchange for various companies acquired.

Permit provides that debenture holders have the option of purchasing units of four shares of preferred and one share of common at $100 instead of converting their debentures.

INSURANCE IN THE NON-METALLIC INDUSTRIES

Conducted by Dwight Ingram

How to Buy Workmen's Compensation Insurance

"Workmen's compensation insurance? Of course I carry it. Accidents are too common in our business for an employer to go without this protection."

Next to fire insurance, workmen's compensation is the most widely carried form of coverage in the cement industry, and the sentiment in the above paragraph represents a typical employer's attitude. In many states it is required by law, and, regardless of legal obligation, employers recognize that it is a cheap way to unload their liability for injuries suffered by employes in line of duty.

What differences of opinion there are on this subject concern mainly the choice of insurance company rather than the advantages of the protection. The policies of all companies agree to meet the employer's full liability for medical expenses and wages. Therefore some folks just "take the company with the lowest rate because the policies are all alike." This quotation has enough truth in it to be dangerous. All policies are alike as to the benefits they offer to injured employes, but not all companies are alike in service and financial stability.

Experience Governs Cost

An employer naturally wants the cheapest insurance consistent with safety, but cost should be considered over a long period and not only for the moment. A manufacturer once said to me, "Every July, I let three or four different companies come in and give me figures on compensation insurance, and then I choose the one with the lowest cost." In spite of this plan his rate had gone up steadily for eighteen years. I have placed his insurance for five years in the same company, and he has enjoyed a reduction on every renewal. What the manufacturer now realizes is that in the long run cost depends on his own loss experience and is controllable by accident prevention work. A safety organization thus becomes the real key to cheap insurance. This means more than the routine inspection work maintained by all companies, with the usual recommendations for guards on machines, belts and floor openings. Accidents are caused by the carelessness of men, and safety work must center on training the plant personnel. Insurance companies vary a great deal in their active initiating of safety measures, and one of the fundamental tests by a manufacturer should be to find out what guidance he can expect in the prevention of accidents.

Loss Reserve Important

The financial strength of an insurance company is peculiarly important. You have not fully measured a company's solvency when you look at its published statement. The distinctive feature of an insurer's liabilities is that they extend indefinitely into the future. Settlements may be tied up by lawsuits, and payments of indemnity may extend over several years. To meet these future contingencies insurers set up a loss reserve, based on their estimate of what the unsettled losses are finally going to cost. A "shaky" insurance company can simply underestimate this reserve and thus create a paper surplus. Possibly the most important test of any insurance company is to find out the general public opinion about its policy of estimating loss reserves.

Agent's Service

The personality of your agent or broker also makes a lot of difference in the handling of insurance, regardless of whether he is a salaried company employe or an independent broker. The agent is the service man. He acts as a watchdog over the company to see that your claims are paid promptly and not sidetracked by "red tape." Prompt claim service means satisfied employes, because workers usually need money in a hurry when they are disabled. It has been my experience that any company will handle its claims faster if an agent is looking out for any delay. The agent should also be the main driving force to keep both your plant superintendent and the company's inspectors steadily at work on safety measures, so that you will be in a position to demand a lower rate when your insurance comes up for renewal. And finally, the agent is the man to hold your premium to a minimum when the audit of your payroll is made at the end of the policy year. Different parts of your work call for varying rates, such as the office, shop and chauffeurs. A skilful agent can guide you in interpreting the rules so that much of your payroll will fall in low-rated classes or in some cases even be exempt from charge.

Montana Has Known Deposit Of Vermiculite

J. T. Pardee and E. S. Larsen have just issued, through the U. S. Geological Survey, a report on a deposit of vermiculite discovered in an old tunnel near Libby, Montana, where examination has shown this mineral to exist in great quantities. Under the name vermiculite are grouped those minerals which expand and give off water when heated. The application of heat causes some members of this group to open into long, worm-like thread, whence the name. The heated and expanded material is very light, exhibits a golden or silvery luster, and appears to have very low heat conductivity, properties that indicate commercial uses that might prove important. The deposit near Libby is more extensive than other known similar deposits and is accompanied by asbestos and feldspar in considerable quantities and by other interesting minerals, one of which carries small percentages of vanadium, a metal useful as an alloy in the making of certain types of steel.

Maps and Report on Little Colorado River

The U. S. Geological Survey, Department of the Interior, has prepared a map of the Little Colorado River from its mouth to the Tolchaco dam site, Arizona, a distance of 103 miles. The map consists of three plan sheets and two profile sheets on a scale of 2 in. to the mile, with contour intervals of 25 and 100 ft. on land and 5 and 25 ft. on water surface. The map is printed in three colors. In connection with this survey, George F. Holbrook, assistant engineer, U. S. Geological Survey, has prepared a brief discussion of the power value of the Little Colorado river. The report describes several reservoir and dam sites in the Little Colorado river canyon. The maps may be obtained for 10 cents a sheet, or 50 cents for the set, on application to the Director, Geological Survey, Washington, District of Columbia.

Five Cement Plants Dedicate Portland Cement Association's No-Accident Trophies

Two Organizations Complete Two Successive Years Of Operation Without a Single Lost-Time Accident

IOLA, Kansas, was the scene of a gala celebration on Thursday, June 20, when the employees of the local plant of the Lehigh Portland Cement Company, accompanied by many other citizens and visitors from neighboring sections, took part in a program arranged for the rededication of the Portland Cement Association's no-accident trophy awarded to the company and its workers for two consecutive years of operation without a lost-time accident. A. J. R. Curtis, assistant general manager of the cement association, made the rededication address on behalf of that body and the award was accepted by the plant superintendent, C. A. Swiggett, on behalf of the company.

A program by the Iola band, a duet by two local musicians and a song by those present provided musical entertainment for the large crowd assembled and lunch was served. The meeting was called to order by Superintendent Swiggett and was then led in prayer by the Reverend H. G. Mathis. In rededicating the safety trophy, Mr. Curtis of the Portland Cement Association made the following remarks:

"Your mill here in Iola is one of the first three in America to work two consecutive years without a lost-time accident. Only a few years ago a record of even one year without accident was inconceivable. For a cement mill to be able to operate two years without an accident was past the limits of anyone's imagination. It remained for your organization, through excellent team work and self-control, to accomplish something which, heretofore, had been regarded as absolutely impossible. Intelligent training, ability and eagerness to work with others toward a common objective, and a brotherly regard for the welfare of fellow workers, are characteristics of your organization which have put this big achievement across.

Portland Cement Association's Safety Flag Atop the Association's Laboratories in Chicago

"On behalf of the members of the Portland Cement Association and the cement mills of America, I extend hearty congratulations on this second trophy dedication to the officials of the Lehigh Portland Cement Company, Superintendent Swiggett, the safety committee, and to every employee of the plant and his family, who provided a most valuable example for the mills which we know they fully appreciate and are profiting by.

"The thrifty community of Iola, which for many years has been well in the forefront of cement-producing localities, has contributed a long list of men who have risen to positions of highest honor and authority in our industry. Last year, in winning the Portland Cement Association trophy, you brought to this community another distinction, which has been achieved only by the most progressive and intelligent mill operators. Now it is my privilege to congratulate your city again on the location of this safe and prosperous cement mill within its borders. Your citizens have long recognized the cement mill as one of the principal sources of the good things which this community enjoys, and we are most grateful that it has been able, with the encouragement of your officials and citizens, to provide its blessings without sorrow or loss to a worker or citizen for well over two years.

"The need for safe thinking is perpetual, and no season, month, day or instant is free from the possibility of accident unless every workman is continually on the alert. We sincerely hope that this concrete monument bearing its new inscription will continue to serve as a constant inspiration and reminder to you all throughout the years."

F. C. Lynch, manager of the Kansas City Safety Council, then spoke, and was followed by Major Henry A. Reninger, special representative of the Lehigh company.

Safety Committee of the Cape Girardeau, Missouri, Plant of the Marquette Cement Manufacturing Company

Colonel E. M. Young, President of the Lehigh Portland Cement Company, Allentown, Pennsylvania

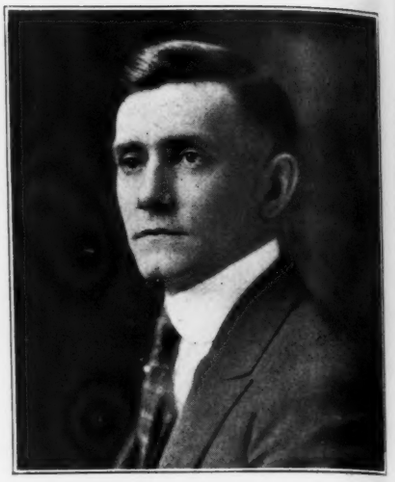
Several of the Lehigh mills have won the Portland Cement Association awards—the Mitchell, Indiana, plant in 1924 and again in 1926; the Iola, Kansas, plant in 1927 and 1928, which occasioned the present ceremony; the No. 3 plant at Ormrod and those at Fogelsville, Bath and Sandt's Eddy, Pennsylvania, last year.

Frank H. Smith, president of the Portland Cement Association, sent the following telegram of congratulation to the officials of the Iola plant:

"Cement association extends best wishes on occasion of your trophy dedication. I know that your entire organization, from President Young to the humblest worker, is justly proud and eager to make a perfect record again in 1929. In this effort you have the best wishes of our industry throughout America. Congratulations to the people of Iola, who have reason to be proud of their mill."

Just five days earlier, on Saturday, June 15, a similar ceremony was staged at Cape Girardeau, Missouri, where the Marquette Cement Manufacturing Company's plant was awarded the cement association trophy for a perfect safety record in 1928. A large and enthusiastic crowd of workers, citizens and visitors from distant points participated in a celebration program, which opened with music by the Cape Girardeau Municipal Band and was brought to a close by a band concert and refreshments served in the open on the plant office grounds. Following an invocation by the Reverend H. C. Joy and an address of welcome by H. O. Cole, plant manager, A. J. R. Curtis delivered the presentation address, in the course of which he said in part:

"The remarkable record of your cement mill here in Cape Girardeau in avoiding personal injury to its workmen for a period of over 500 days, is the wonderful circumstance which brings us together to-day. . . . Last year you won the most distinguished honor it is possible for a mill organization to attain by achieving what men have considered the impossible. Therefore, I am happy to convey the congratulations of our entire industry to W. A. Wecker, secretary-treasurer of the Marquette Cement Manufacturing Company; to Richard Moyle, Sr., general superintendent; H. O. Cole, plant manager; R. C. Matthews,

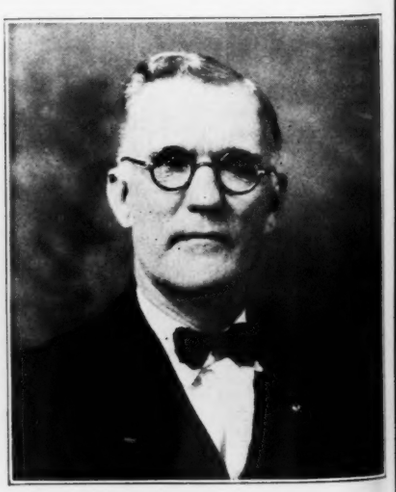


R. B. Dickinson, Vice-President and General Manager, Marquette Cement Manufacturing Company

Safety Committee of the Bellevue Plant of the Alpha Portland Cement Company

C. A. Swiggett, Superintendent, Iola, Kansas, Plant, Lehigh Portland Cement Company

M. P. Greer, Safety Engineer, Cape Girardeau Plant, Marquette Cement Manufacturing Company



R. C. Matthews, Superintendent, Cape Girardeau Plant, Marquette Cement Manufacturing Company

G. S. Brown, President of the Alpha Portland Cement Company

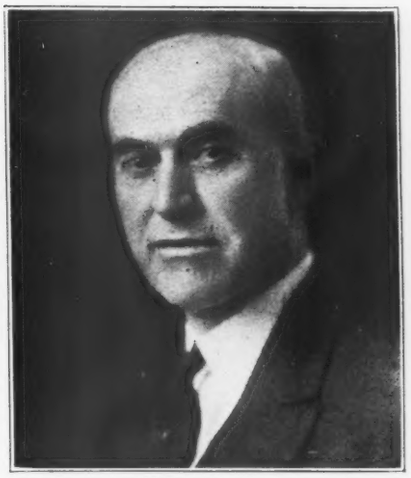
superintendent; M. C. Greer, safety engineer, and to every employee and his family. You have earned the respect of your entire industry and community."

J. G. Thompson, chief chemist of the Marquette concern, accepted the trophy for the company and Senator Russell L. Dearmont then addressed the assembly on "The Golden Rule of Safety." The safety committeemen and the safety police force were then presented with safety prizes.

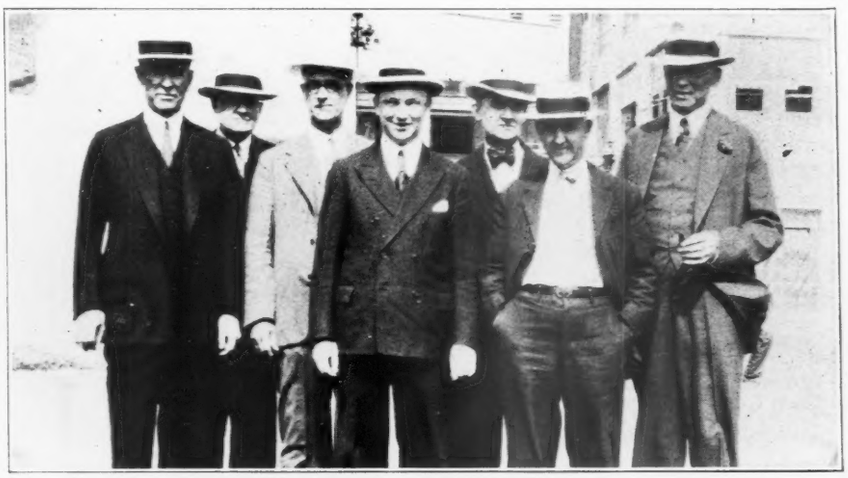
Within recent weeks three other cement plants have been presented with the Portland Cement Association award under similar circumstances. On May 30 a large crowd assembled on the grounds of the Consolidated Cement Corporation's plant at Mildred, Kansas. This plant has succeeded in reducing the number of lost-time accidents from 41 in 1924 to none in 1928, the number of days lost from 651 to none and the number of fatalities from two to none, all in the same period. The 1927 record would have been perfect but for a single sociation safety award, the former plant-yard accident involving a loss of five days.

Credit for this remarkable improvement is due to the company's operating department, which was led by James E. Curtis, general superintendent; R. M. Johnson, district superintendent; C. E. Coran, superintendent; and E. L. Drury, assistant superintendent. The efforts of this organization proved so productive that in the second year of its work one department and in the third year six departments worked through the year without a single accident. Constant vigilance resulted in the attainment of a perfect no-accident record in 1928 and the award of the trophy this year.

The Ironton, Ohio, and Bellevue, Michigan, plants of the Alpha Portland Cement Company were also the recipients of the Portland Cement Association award through a rededication of the award won first in 1928 for a perfect safety record in 1927 and now again for a similar record made last year. The Ironton mill and two others, the Iola plant already mentioned and another at Cowell, California, are the first in America to work two consecutive years without a lost-time accident.

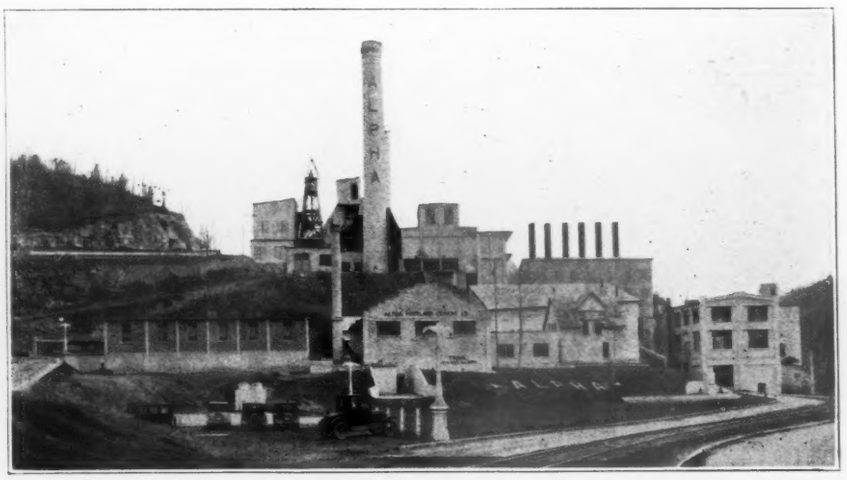


C. A. Irvin, Vice-President, Alpha Portland Cement Company



C. A. Irvin, Vice-President, and H. McClarnan, General Superintendent, the Alpha Company; T. G. Kearns, Superintendent, Safety Department, Ohio Industrial Commission; A. J. R. Curtis, Assistant General Manager, Portland Cement Association; Dr. G. C. Hunter, Ironton Plant Surgeon, J. R. Paul, District Sales Manager, and G. S. Brown, President, the Alpha Company

G. A. Lawniczak, Superintendent, Alpha Portland Cement Company, Bellevue



The Trophy Winning Plant of the Alpha Portland Cement Company at Ironton, Ohio

Photo © Blank & Stoller

J. L. Senior, President of the Consolidated Cement Corporation

G. S. Brown, president of the Alpha company, in responding to the rededication address of Mr. Curtis of the cement association, said in part:

'A year ago, when we gathered here to dedicate this trophy, I experienced a deep sense of pride in this organization which naturally followed the feeling of envy when others had previously won trophies and we could not. Sometimes some of us doubted that an absolutely clear record could be made. But we know now that it can be done and I congratulate you men who have done it. A year ago I expressed the hope that I could come back here again this year, and here I am. Now I am hoping to come back for similar occasions in 1930, 1931 and for many years."

Charles A. Irvin, vice-president in charge of the western division of the Alpha company, speaking of the company's attitude toward factory hazards, said:

"It is our aim and desire to surround our employees with the highest safety factor, but a record such as you have established here at this plant cannot be accomplished without the hearty cooperation of each employee. In this great cause it is team work that counts. I can assure you gentlemen that there is nothing more depressing to the officers of the company than to be advised that an employee has been injured or killed. I want to congratulate you upon establishing such a remarkable record, and you have my best wishes for a continuance of your accomplishments."

Of the 17 cement plants which have been awarded the Portland Cement Association trophy for 1928, nine—those named herein and the plants of the Lehigh Portland Cement Company at Bath, Fogelsville, Sandt's Eddy and Ormrod, Pennsylvania—have already had their trophies dedicated. The eight remaining dedications are scheduled to take place as follows: the Cowell, California, plant of the Cowell Portland Cement Company and the Dallas, Texas, plant of the Trinity Portland Cement Company on July 4; the Mannheim, West Virginia, plant of the Alpha Portland Cement Company on July 6; the Exshaw, Alberta, plant of the Canada Cement Company, Limited, on July 15; the Oswego, Oregon, plant of the Oregon Portland Cement Company on September 18; the Quincy, Michigan, plant of the Wolverine Portland Cement Company on October 10; the Painesville, Ohio, plant of the Standard Portland Cement Company and the Kingsport, Tennessee, plant of the Pennsylvania-Dixie Cement Corporation on dates to be announced.

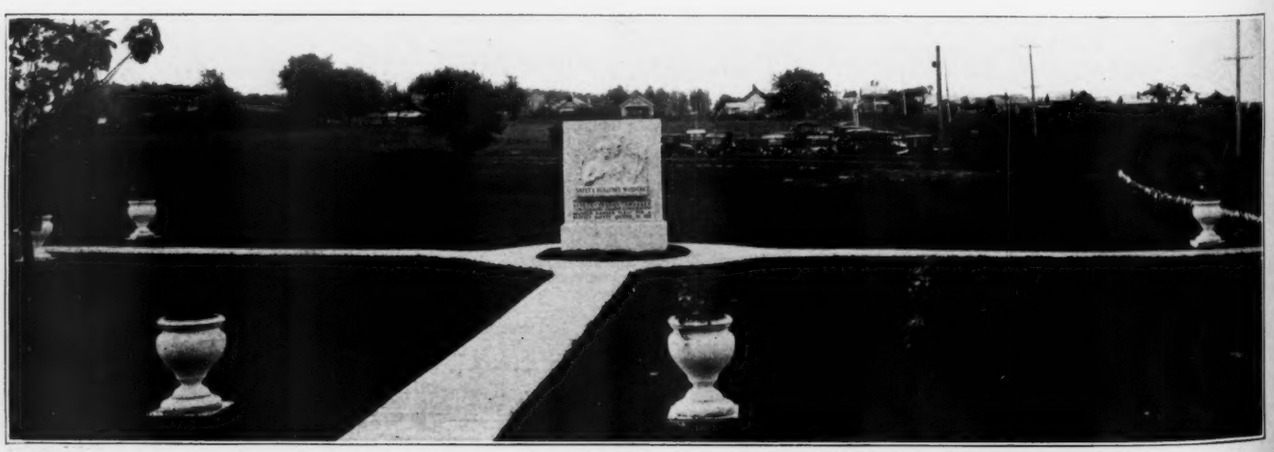
R. M. Johnson, District Superintendent, Consolidated Cement Corporation

Photo © Blank & Stoller

J. E. Curtis, General Superintendent, Consolidated Cement Corporation

Prize Competition Planned For Airport Designs

A $10,000 prize contest open to architects, engineers and city planners has been announced by the Lehigh Portland Cement Company of Allentown, Pennsylvania, to encourage better designs for modern airports. Designs must be received by midnight of November 18. This competition is the first of its kind held in the United States, although similar contests were held abroad last year in England, France and Germany and produced favorable results.



The Portland Cement Association Trophy Won by the Mildred, Kansas, Plant of the Consolidated Cement Corporation

Pit and Quarry

ANNUAL Cement Mills SECTION

BURRELL

ENGINEERING and CONSTRUCTION CO.

DAILY NEWS PLAZA [21st Floor] CHICAGO, ILL.

MACDONALD

Puts 'em up "Out West"

From bare prairie to complete plant in operation! Such was the preformance of the Macdonald Engineering Company for the Monolith Midwest Portland Cement Company at Laramie, Wyoming. This modern wet process plant with an initial capacity of 2000 bbls. a day is near the site of historic old Fort Sanders, a famous fort in the early gold rush days.

The Macdonald Engineering Company handled all the concrete work, even to the making of concrete roof tiles. We also furnished and erected all the structural steel, using approximately 1200 tons. We erected all the electrical equipment, set up all the machinery. This plant has a complete machine shop, capable of handling practically all repair work necessary.

The Pacific Portland Cement Co. plant near Redwood City, California, pictured below, offered some very interesting and difficult engineering problems. The land on which this plant was built was tidal flat incapable of supporting the buildings and machinery. It was therefore necessary to sink a great number of pilings before any buildings could be erected. We carried out all of the concrete work in connection with doubling the size of the plant.

The efficiency and dependability of Macdonald built structures is attested by the great number of complete plants and units erected by this organization during the last thirty years. Quality work, *on time*, at reasonable cost, regardless of conditions.

Write or wire our nearest office

Macdonald Engineering Co.
Chicago San Francisco Toronto

The Macdonald Spencer Engineering Co., Inc.
Graybar Building New York City

New Plant of Monolith Portland Midwest Company at Laramie, Wyoming Now Operating

Formally Opened on June Twenty-second

NEAR the site of historic old Fort Sanders, two and one-half miles east of Laramie, Wyoming, in the path beaten by the early pioneers and gold rushers in their journey to the gold fields of California a new and modern cement plant has been erected. This new plant is operated by the Monolith Portland Midwest Company, a subsidiary of the Monolith Portland Cement Company of Los Angeles, California, and is a monument to the enterprise and vision of Coy Burnett, president of both companies.

The formal opening of the plant was held on June 22 and was attended by a large number of stockholders, chiefly from California, as well as a majority of the officers of the company. The completion of this Laramie plant marks another step forward in the plans of the Monolith Portland Cement Company of California, the parent company. It is understood that preliminary surveys are now under way for the erection of another plant in Texas on the Gulf of Mexico. The officers of the Monolith Portland Midwest Company are almost identical with those of the Monolith Portland Cement Company of California.

Coy Burnett, President, Monolith Portland Cement Company and Monolith Portland Midwest Company

The mill is located near the main line of the Union Pacific Railroad and adjacent to the Denver-Laramie Highway. It is a wet-process plant with an initial capacity of 2,000 barrels a day and was designed and built under the supervision of

Machine Shop at Right, Kiln and Coal Drying Buildings in Background

Carrol A. Low, Vice-President and General Manager, Monolith Portland Cement Company, and Monolith Portland Midwest Company

F. L. Smidth and Company. The Macdonald Engineering Company was the contractor.

The design is such that the plant can be enlarged sufficiently to bring its capacity up to 6,000 barrels a day without interference to operation. This plant, in addition to being the newest and one of the most modern plants in the United States, has the added distinction of being the highest, its elevation being approximately 7,200 feet above sea level.

The property, consisting of 2,200 acres, has an unusually good deposit of limestone varying from 60 to 80 feet in depth. The stone is in what is known to geologists as the Niobrara formation and is badly shattered and broken up as well as being mixed with clay. This combination forms an almost perfect raw mix at this point, requires very little blasting and is unusually easy to quarry and crush. No secondary shooting is necessary. The overburden, which averages about 3 feet in thickness, is removed by a Stroud grader pulled by a 60-ton caterpillar tractor.

Quarrying Operations

The quarry is located on the Laramie river, 9 miles west of the plant. The stone is loaded by a Marion No. 31 steam shovel with a ¾-yd. manganese dipper into 20 cars, each consisting of 3 side-dump skips laid side by side on ordinary 40-ton railroad flat cars. These cars are hinged at one end to allow discharging by simply raising the other end. The cars are hauled to the plant by a 65-ton Baldwin locomotive. About 700 tons of stone are quarried daily.

The 12-mile standard gauge railway from the quarry to the plant is operated by a Laramie Valley Railway Company, the stock of which is all owned by the Monolith Portland Midwest Company. This railroad was built under great difficulties, as the land which it traverses is mostly swamp. At the plant the track forms a loop passing through the west end of the crushing plant. The slope of this track allows the cars to be fed to the crusher by gravity releasing the locomotive to get another trainload of stone.

Crushing and Raw Material Storage

In the crusher building the skips are dumped by a 25-ton Northern Engineering Works electric over-

Shovel Loading Skip Cars in Quarry

head hoist into the 36-in. Traylor Bulldog gyratory crusher. The hoist also handles repair parts. The crusher reduces the material to 6-in. and under and discharges onto a Chain Belt Rex 48-in. steel bucket conveyor to a storage bin. This bin insures a steady flow of material to the plant regardless of any ordinary fluctuation in the flow of material from the quarry. The crusher is direct driven by a 200-hp. motor and the conveyor by a 60-hp. motor through a Cleveland speed reducer.

Rock is drawn from the bottom of this bin by a Pennsylvania reciprocating feeder, which discharges into a Pennsylvania No. 12 hammermill, reducing the material to ⅝-in. maximum. The hammermill discharges onto a 30-in. by 254-ft. centers inclined belt conveyor feeding a 30-in. by 200-ft. centers cross belt conveyor, which discharges onto the raw material storage pile. The feeder is driven by a 10-hp. motor through a DeLaval speed reducer and the hammermill by a direct connected 300-hp. synchronous motor. The conveyors were furnished by the Chain Belt company and the belting by the Pioneer Rubber Company. Both conveyors are driven through Cleveland speed reducers.

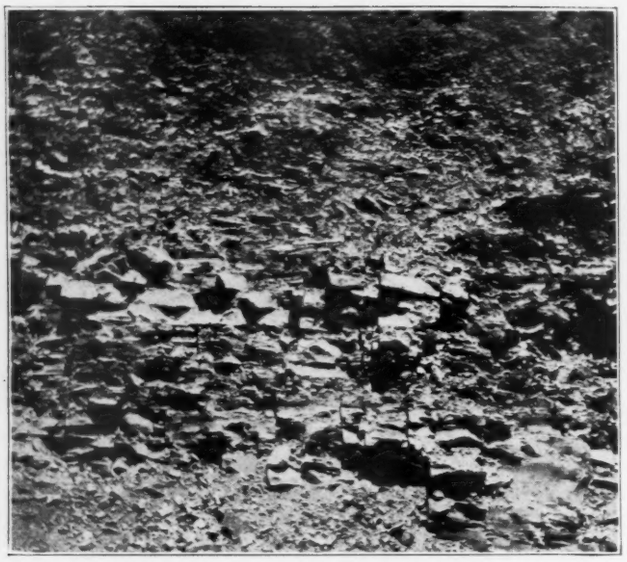
The storage building is 61 ft. wide and 242 ft. long and is divided into compartments for stone, clinker, gysum and coal. The storage capacity for stone is now about 6,000 tons and for coal about 2,000 tons, but these can be extended if necessary. The clinker storage has a capacity of over 55,000 barrels and the gypsum storage of about 1,000 tons.

Raw Grinding and Slurry Mixing

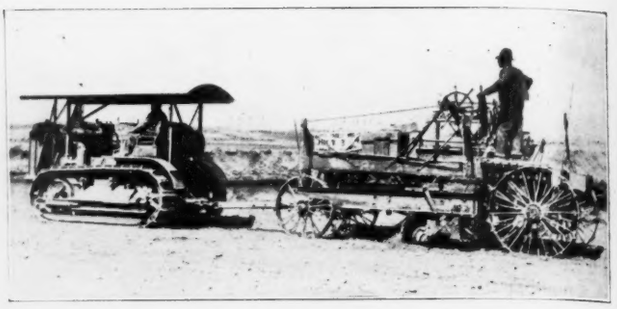
A 40-ton P. & H. overhead traveling crane with a 76-ft. span and equipped with a 3-yd. Hayward clamshell bucket rehandles the material into hoppers over the raw mills. At present one F. L. Smidth 7-ft. by 39-ft. Unidan 3-compartment mill does all of the raw grinding. It is equipped with a Smidth table feeder and is driven by an Electric Manufacturing Company 600-hp. synchronous motor through a Symetro-Tronyon drive. Due to the almost perfect proportions of the raw materials, no proportioning is necessary at the mill, except the addition of about 38 per cent of water.

Train of Cars Being Loaded in Quarry

Interior of Raw Material Storage Building With Mill Bins at Right



Closeup Showing Type of Rock in Quarry Face



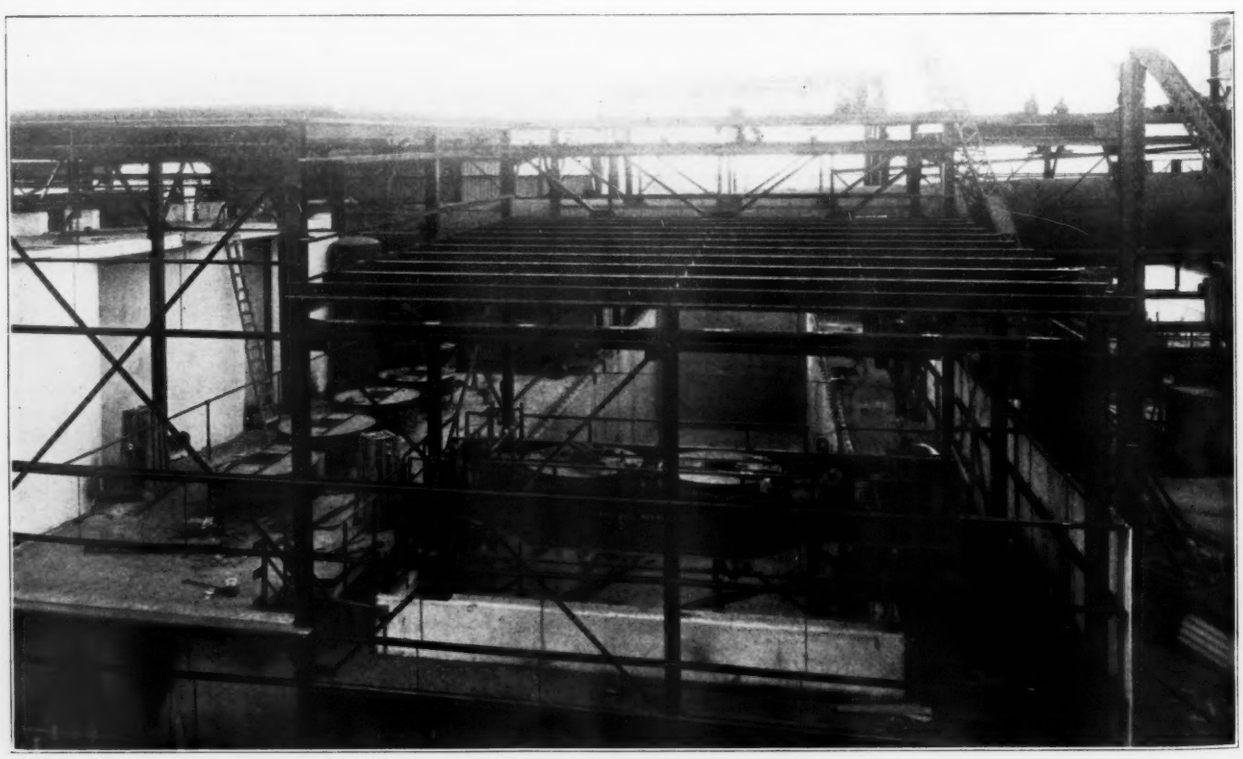
Tractor and Grader Stripping Overburden at Quarry

The slurry from the Unidan mill flows to a sump under the correcting basins from which it is conveyed by two No. 4 Wilfley centrifugal pumps, each of which is capable of handling the entire output of the Unidan mill, to the three correcting tanks. These tanks are of reinforced concrete, 20 ft. in diameter by 18 ft. deep, with a total capacity of 2,400 bbl. F. L. Smidth agitating equipment is used. The slurry discharges by gravity to an oval mixing basin 52 ft. long, 20 ft. wide and 21 ft. deep; also equipped with Smidth agitating machinery. The mixing basin discharges by gravity into a rectangular storage basin 125 ft. long, 25 ft. wide and 21 ft. deep with a capacity of 7,200 bbl. This basin is equipped with a Smidth traveling agitator.

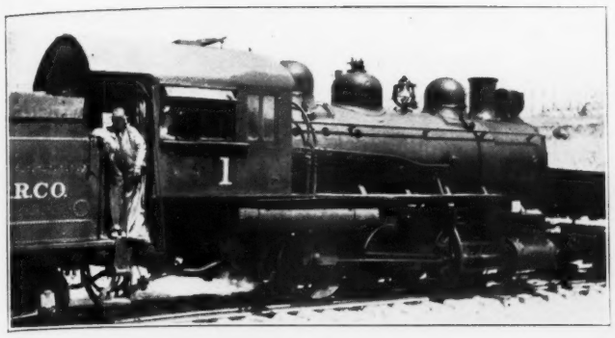
Kilns and Coolers

Two No. 4 Wilfley pumps convey the slurry from the storage basin to the kiln feeder, one pump being kept in reserve. The Smidth scoop feeder is driven in fixed relation with the speed of the kiln and has a Stephens-Adamson speed changer, which allows variations in speed to meet different conditions. A speed indicator and revolution counter record on the kiln control panel. This control panel was designed by F. L. Smidth and Company and controls every operation in the kiln department.

The single kiln is 343 ft. long and 11 ft. 3 in. and 10 ft. in diameter. The feed end has a Smidth patented chain system, which breaks up the slurry and increases the burning efficiency. The discharge end is equipped with a Smidth Unax cooler of the single row type, consisting of ten tubular sections arranged concentrically about the kiln. The kiln



Slurry Storage and Mixing Tanks at Left, Feed Tank with Traveling Agitator in Center, Kiln in Background



Locomotive Hauling Rock from Quarry to Plant

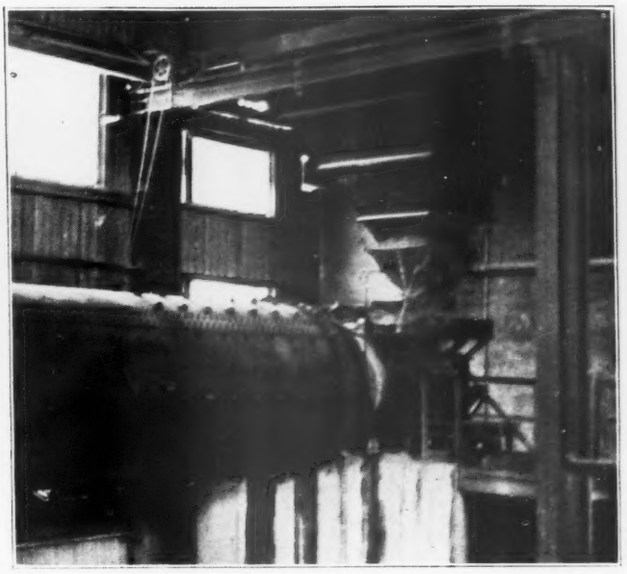
was designed by F. L. Smidth and Company and built by the Traylor Engineering and Manufacturing Company.

The fire brick lining was furnished by the General Refractories Company, while the insulating bricks are Moler bricks furnished by F. L. Smidth and Company. The kiln draft is controlled by two induced draft fans and the 150-ft. concrete stack. The steel smoke chamber and a special sealing device connecting it with the kiln were designed and built by F. L. Smidth and Company.

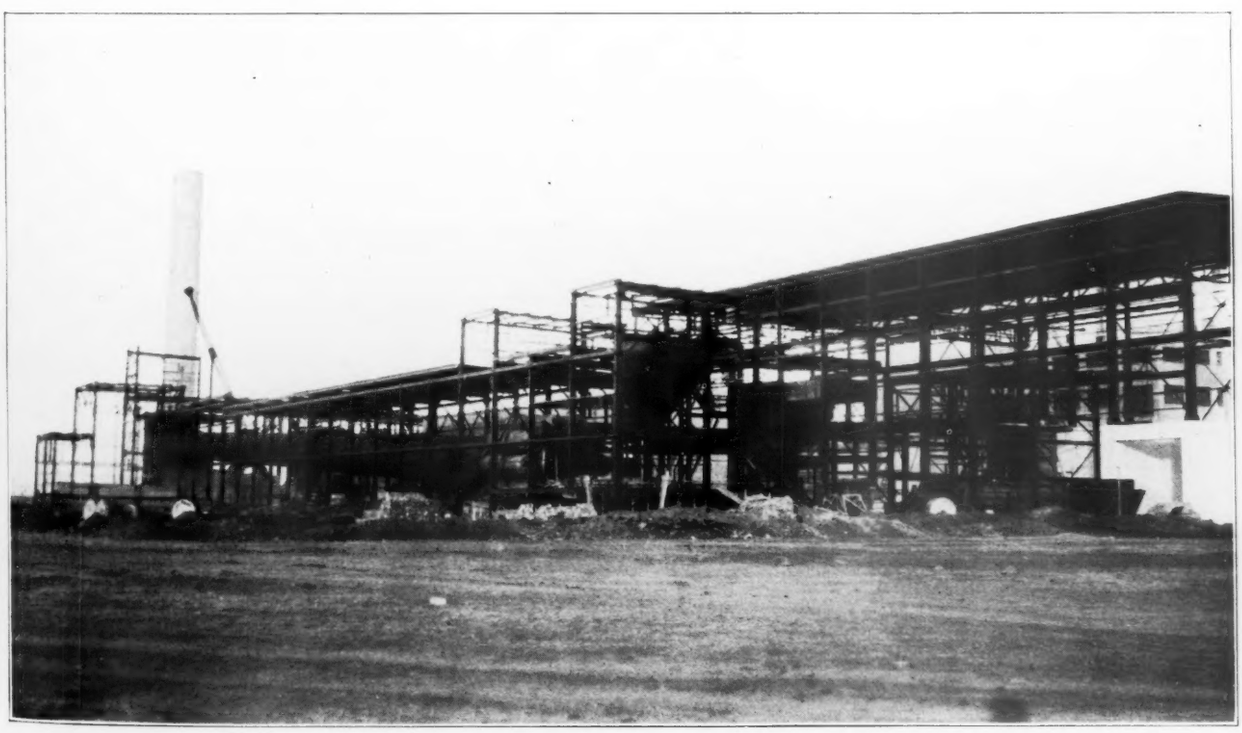
Final Grinding

The Unax cooler discharges the clinker into a Smidth Skipulter, which in turn discharges into a bucket elevator at the storage building. The clinker drops onto a pile, from which it is distributed by the same P. & H. traveling crane previously mentioned. This crane also feeds the clinker and gypsum from a nearby storage pile into bins over the finish grinding mill.

Clinker is withdrawn from its bin by a cradle feeder and gypsum by a feed screw, both furnished by F. L. Smidth and Company. The feed screw is driven by a variable speed motor through a Cleveland worm gear speed reducer. Both feeders discharge into a Smidth 7-ft. by 39-ft. Unidan mill similar to the one used for raw grinding. This mill is also driven by an Electric Manufacturing Company 600-hy. synchronous motor through a Symetro-Tronyon drive. These drives were designed by F. L. Smidth and Company and allow the use of high speed, high efficiency motors. The finished cement discharges from the mill into a 16-in. screw conveyor feeding a 6-in. Fuller-Kinyon pumping system, which conveys the cement to the storage silos.

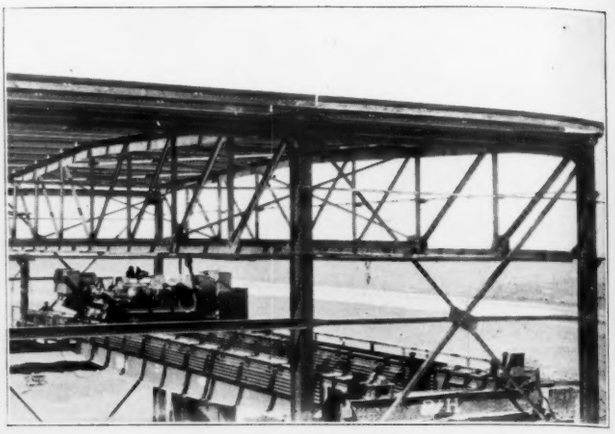


The Raw Grinding Mill



Kiln Building from Southwest. Type of Coolers Clearly Shown

Caol Elevator and Stockpile
in Storage Building

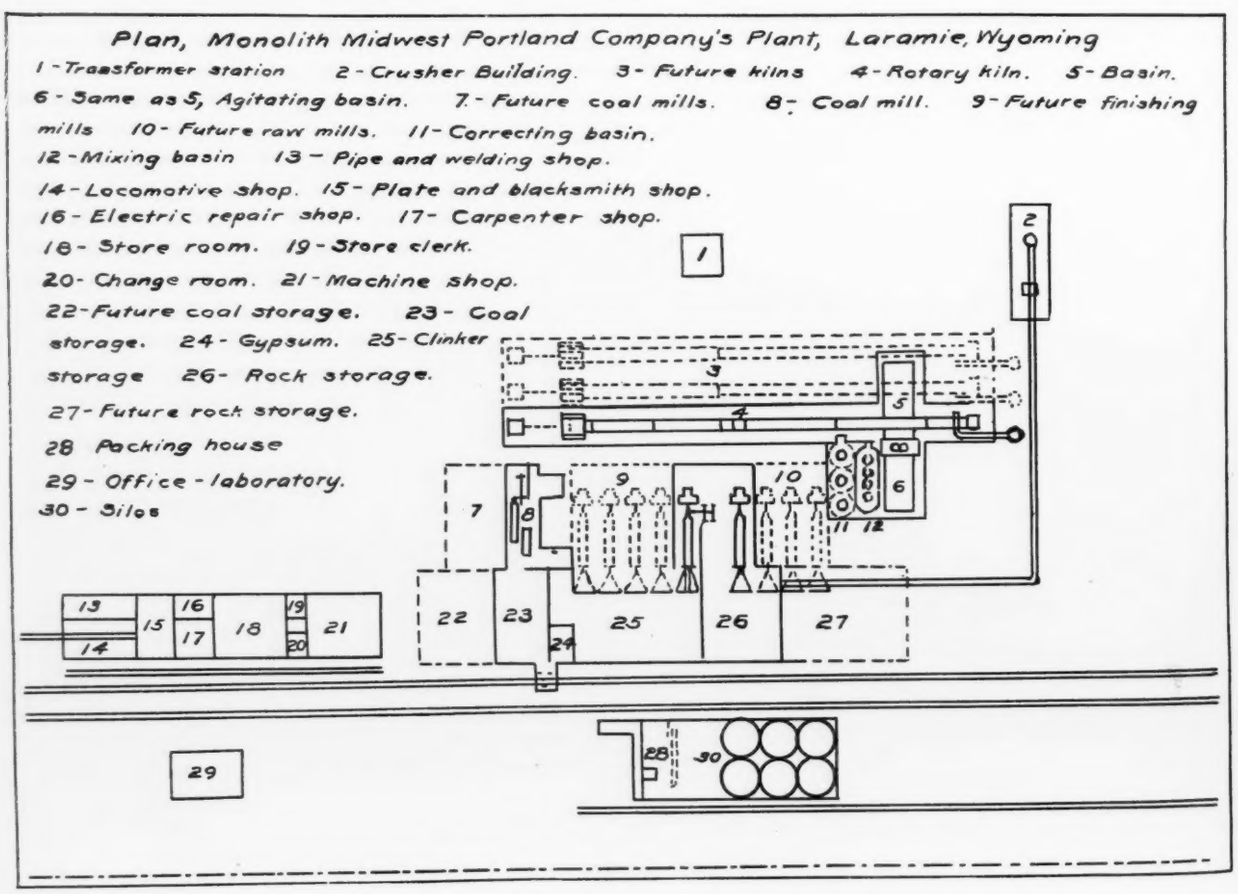


Traveling Overhead Crane
in Storage Building

Storage and Packing

The six reinforced concrete storage silos, each 32 ft. in diameter by 80 ft. high, together with the interstice bins, have a total capacity of 120,000 bbl. The cement is drawn from the silos by F. L. Smidth Exbiners and discharged into screw conveyors in four tunnels under the silos. These conveyors discharge into 20-in. collecting screw conveyors, which in turn discharge into bucket elevators to the third floor of the packhouse. The elevators discharge into 20-in. screw conveyors, which distribute the cement to bins over the two 3-valve Bates packers. The packhouse is arranged for both car and truck shipments.

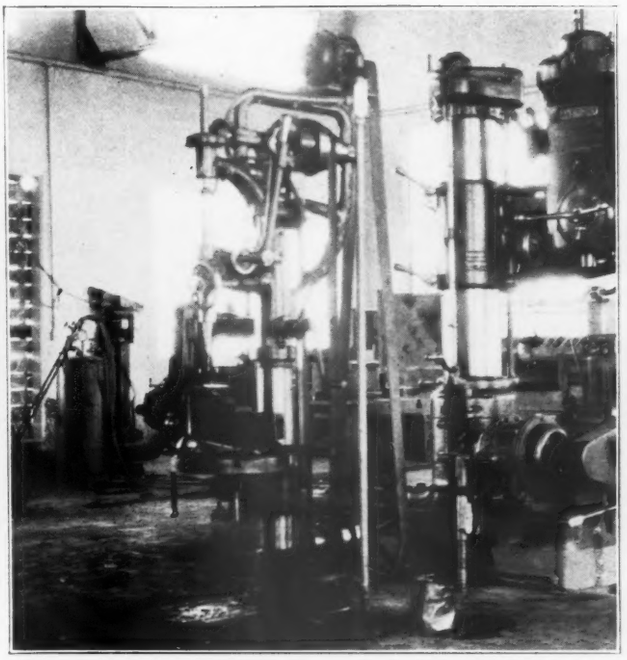
A 2-ton capacity freight elevator in the packhouse carries returned bags to a Bethlehem Foun-


Plan, Monolith Midwest Portland Company's Plant, Laramie, Wyoming
1 - Transformer station 2 - Crusher Building. 3 - Future kilns 4 - Rotary kiln. 5 - Basin.
6 - Same as 5, Agitating basin. 7 - Future coal mills. 8 - Coal mill. 9 - Future finishing mills 10 - Future raw mills. 11 - Correcting basin.
12 - Mixing basin 13 - Pipe and welding shop.
14 - Locomotive shop. 15 - Plate and blacksmith shop.
16 - Electric repair shop. 17 - Carpenter shop.
18 - Store room. 19 - Store clerk.
20 - Change room. 21 - Machine shop.
22 - Future coal storage. 23 - Coal storage. 24 - Gypsum. 25 - Clinker storage 26 - Rock storage.
27 - Future rock storage.
28 Packing house
29 - Office - laboratory.
30 - Silos

Sketch and Key Showing Plant Layout

MONOLITH PORTLAND MIDWEST CO.
F.L.Smidth & Co., Inc. New York. Designing Engineers
Macdonald Engineering Co. Chicago. Erecting Engineers
MONOLITH PORTLAND and WATERPROOF PLASTIC CEMENTS

Sign on Highway Near Plant



Interior of Machine Shop

dry and Machine Company continuous bag cleaner, which has a capacity of 5,000 bags per hour. As the sacks leave the cleaner they fall to a 36-in. by 42-ft. belt conveyor, on which they are sorted. A Bates automatic bag tier is used to tie the sacks. The bag cleaner is driven through a Pacific Gear and Tool Company speed reducer and the conveyor by a 5-hp. motor through a Cleveland speed reducer. Three Sly dust arresters are provided for the bag cleaner and the two packers. Each of these units has a Serocco blower driven by a 10-hp. motor.

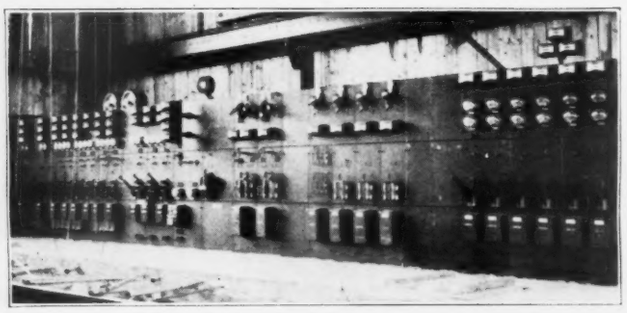
Coal and Gypsum

Coal and gypsum are shipped to the plant in railroad cars, which discharge into a truck hopper. A Mead-Morrison roll crusher reduces to the desired size. The crusher feeds to an elevator which discharges into a movable spout, so that it can feed to either the coal or gypsum storage piles. The overhead crane rehandles the gypsum to the finish mill bin, as previously mentioned, and the coal to a feed bin over the Schaffer poidometer. The poidometer feeds an F. L. Smidth Pyrator. The dried and powdered coal is then conveyed to the kiln bin by a 6-in. Fuller-Kinyon pump.

Water and Power

Water for plant operations is obtained from two deep wells by Ingersoll-Rand air lifts. One of the wells is 1,625 ft. and the other 1,350 ft. deep. They discharge into a reinforced concrete reservoir. Two centrifugal pumps deliver the water to all parts of the plant. Waste water from the plant is pumped

Cement Silos and Packhouse



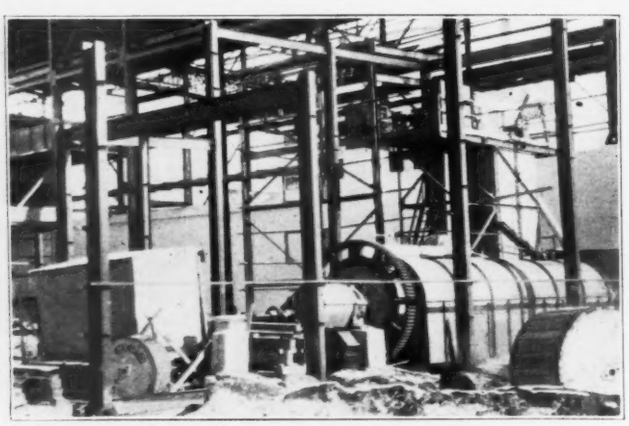
The Main Switchboard Controlling All Plant Operations

back to the reservoir by two more centrifugal pumps.

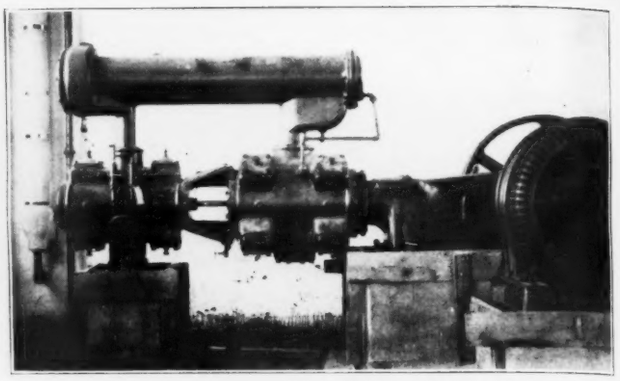
The power house and electrical equipment were designed by and in accordance with the specifications of F. L. Smidth and Company. All a.c. motors of more than 50-hp. use 2,200-volt current, those of less horsepower are 440-volt. Power is purchased from the Western Public Service Company at 13,000 volts and is transformed to 2,300 volts at an outdoor substation. Current for the 230-volt d.c. motors and excitation for the synchronous motors is furnished by two 250-kw. synchronous motor-generator sets. One of these, driven by a 8-cyl. 300-hp. Sterling gasoline engine, is reserved for emergencies. An Ingersoll-Rand two-stage compressor driven by an Electric Manufacturing Company 115-hp. synchronous motor furnishes air for the Fuller-Kinyon pump systems. All motors except those otherwise mentioned, the main switchboard, the starting equipment and the two motor-generator sets were furnished by the General Electric Company.

Machine and Repair Shops

Very complete machine and repair shops are maintained. The equipment consists of a Rockford shaper and planer, an Oster pipe threader, a Toledo pipe threader, a Buffalo drill press, a Buffalo steel cutter, an American radial drill press, a South Bend 18-in. lathe, a Landis bolt threader, a power hack saw and power emery wheels, and an Ingersoll-Rand duplex compressor with 13-in. by 8-in. by 10-



Coal Grinding Mill in the Coal Building



One of the Compressors

in. cylinders. This compressor is driven by a 70-hp. Electric Manufacturing Company synchronous motor and furnishes air for the shop and for the two deep well pumps. Complete equipment for arc and acetylene welding is maintained.

The storeroom is also very complete. A Canton portable crane is used for moving the heavier materials. The carpenter shop is equipped with the various tools necessary as well as a power band saw, benches, etc. The blacksmith shop has a Little Giant 100-lb. power hammer and all other necessary tools. An up-to-date electrical shop, as well as a completely equipped laboratory and plant hospital, are maintained.

Officers

Officers of the company are: Coy Burnett, president; Carroll Low, vice-president and general manager; J. J. Calkins, secretary and treasurer; and W. S. Trueblood, production manager. Sam D. Clinton is sales manager with offices in Denver. F. J. Anderson is plant superintendent.

Jamesville Quarries Break 25,000 Tons of Rock

Approximately 25,000 tons of rock was recently made available for road building in Onondaga county, New York, when an 11,300-lb. charge of dynamite—the second largest in the history of the plant's operations—was set off at the county's stone quarries at Jamesville. Thirty-two charges, averaging about 350 lb. to the hole, were set off, some of the holes reaching a depth of 50 ft. For a distance of about 20 ft. the rock was blown away and it is expected that a few more similar blasts will bring the wall back to private property, and will necessitate deeper workings at the Jamesville-Pompey road.

F. T. Ransom, technical expert, and Morris Harrigan, both of the New York office of E. I. du Pont de Nemours & Company, Incorporated, were present at the operations. The quarries, which are under the management of James Pierce, employ an average of 100 penitentiary convicts and 15 to 20 paid workers.

Technical Aspects of Slurry Filtration

By C. H. SONNTAG

THE technology of cement manufacture, like that of other large scale industries, has not been a matter of smooth and uninterrupted progress, but rather has been marked by a succession of new ideas, which stand out conspicuously among the vast number of minor improvements that are made from day to day. In the iron and steel industry, for instance, we have seen the Bessemer converter, the acid and basic open-hearth processes, the electric furnace, and the electrification of main roll and other drives that is still going on. In ore treatment, there has been the change from granular to fine grinding, electrolytic methods, and flotation concentration. Our own industry has taken up successively the rotary kiln, pulverized coal fuel, larger and longer kilns, large centrifugal grinders, the rejuvenated wet process, pipe-line transport of dry raw material, coal dust and cement, and compartment mills.

No one of these things has been immediately and universally accepted and adopted. Of course there is a financial side to this—the money to make costly changes must be found, even though the change is amply warranted. But aside from that, none of these ideas has come to the industry as a finished proposition. Each has had to go through a period of pioneering, trial, experiment and adjustment, and those who have had the foresight and faith to take these things up and work them out to the practical stage should have full credit for doing so.

The newest comer into the field is the partial dehydration of slurry. It is still in the later stages of trial, and while a number of installations are in operation and more are projected, and quite a body of working data has been accumulated, so that it is possible to discuss it in print, it is quite likely that further improvements may be made.

Vacuum filters have been in use in other industries for a number of years, and the list of substances on which they are used is a long and varied one. To mention only a few, cyanide slimes, flotation concentrates, synthetic gypsum, starch, white lead and other paint pigments, clays of various kinds, paper pulp, and the calcium saccharate formed in sugar refining are all being handled successfully in this way, so that the filtration of cement slurry is a perfectly logical step to take.

The basic idea of filtering slurry is not new, and is not patentable, as it was suggested as a possibility over twenty years ago. The thought remained dormant until recently, and it is fortunate that filters already developed for the mining and other industries could be used for slurry with no radical changes. This, more than anything else, is responsible for the comparative ease with which filters may be installed in existing mills. All that was needed was someone to take the first step, and this was done by Henry Ford, who has pioneered in so many things.

There are three types of filters in use on cement slurry, known as the Feinc, the Oliver and the American. The two latter are made by the same organization. All use cloth as the filtering medium, and all work on the same cycle, which consists of three parts:

(1) Building up the cake by applying suction to one side of the cloth while the other side is immersed in a bath of slurry,

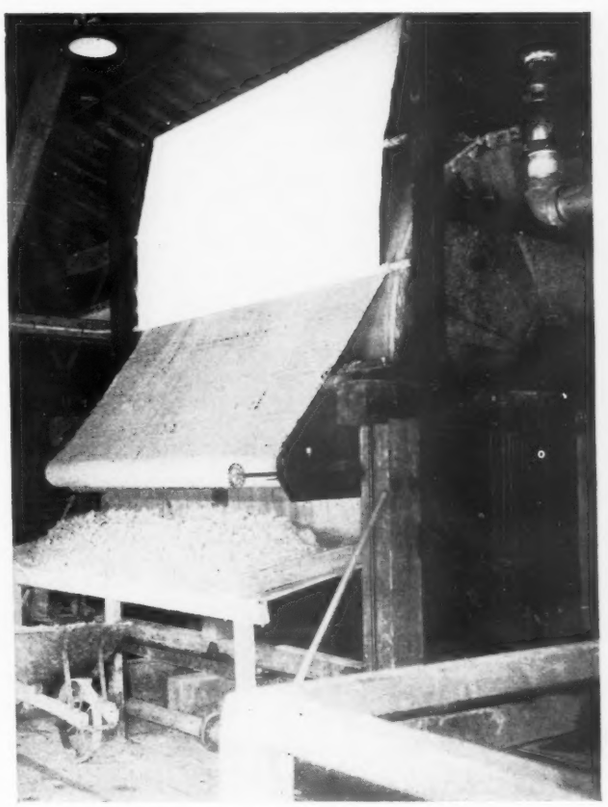
(2) Drying the cake by continuing the suction after withdrawal from the bath,

(3) Release of the cake from the filter.

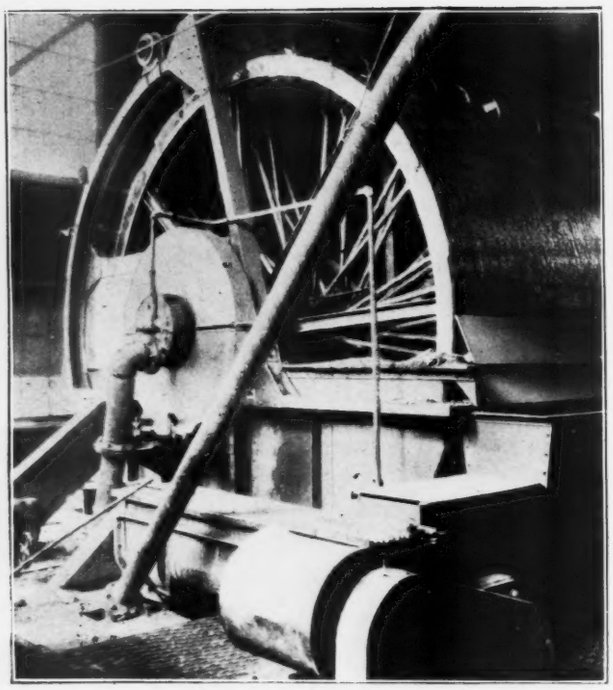
The three makes of machines differ only in their mechanical construction, and in the means for removing the cake from the filter.

The Feinc Filter

This machine is of the drum type. The drum, while apparently continuous, is really made up of a number of longitudinal sections, each of which may be successively connected to a source of low vacuum, to a higher vacuum, and to the atmos-



The Feinc Filter



Oliver Drum Filter

phere. Most of the lower half of the drum is immersed in a tank of slurry, in which it slowly revolves. Each of the drum sections is subjected to a low vacuum as it passes beneath the surface of the slurry. This low vacuum is maintained until the first layers of cake have been deposited, since the engineers of this company believe that the cake is more pervious or porous if the first layers are not subject to high vacuum at the moment of their formation. The cake is built up against the cloth covering, its thickness depending on the rate of revolution, the vacuum and the nature of the slurry. A little later in the cycle the vacuum in the section is increased to the highest attainable, and this continues after the section has left the bath of slurry. During this time about half the water in the cake is withdrawn. Around the drum and moving with it, but not attached to it, are a large number of small cords, which are led around two guide rollers. As these cords leave the drum, they carry the filter cake with them as a continuous sheet, which breaks up and drops away cleanly as the cords pass around the first roller.

The Oliver Filter

This machine also is of the drum type, and much resembles in appearance and method of operation the one just described. It does not, however, definitely provide two different degrees of vacuum, and there are no stripping cords. The cake is removed by a scraper set close to the surface of the drum.

The American Filter

This differs from the others in appearance, for it is made up of a number of cloth-covered discs mounted side by side on a large cast-iron shaft in which are the passages for filtrate, vacuum and low-pressure air. Each disc is made up of a number of separate sectors corresponding to the sections of the drum filters. The cake is built up and the water withdrawn from it as in the other two machines but the third step in the cycle is not the same. In this the inside of each sector is subjected to a low air pressure of two or three ounces per square inch, which is just enough to bulge the cloth out against the scrapers that remove the cake. The air pressure and bulging help to free the cake from the surface of the cloth.

In all three machines the cycle is carried out by means of a rotary valve on the end of the filter shaft. Rotation is very slow, ranging from one revolution in three minutes to one in ten or twelve minutes, depending on the nature of the slurry and other working conditions. The descriptions cover the basic features only, but the manufacturers will be glad to give complete details.

The vacuum must be as high as possible, preferably 27 or 28 inches. The air and water pass into a receiver which if possible is drained by a barometric leg, though if there is not drop enough for this a removal pump may be used. The vacuum pumps so far used are of the reciprocating dry type, and may be belt-driven or, if large enough, direct-connected by synchronous motors. Most cement mills will probably wish to use the second arrangement, as the motors normally run much underloaded.

If the filtrate is to be returned to the grinding mills or otherwise disposed of by pumping, the Wilfley pump seems the best one to use, as the filtrate may contain slurry for short periods due to failure of the filter cloth. This pump is already standard in many wet process mills. It is another machine that has come to us from the mining industry. It can not be used as a removal pump, as it can not exert suction, and the water must come to it under slight pressure.

While the mechanical features of the filters themselves have been satisfactorily worked out along the lines indicated, a complete installation involves more than the bare filter. It must be properly located in a mill that quite likely was not designed with filtration in view; the cake must be fed to the kilns; the filtrate must be disposed of. There will be progress along these and other lines, and a filter installation made five years hence may not look much like one built today. The possibility of saving money by filtration is so great, however, that the process, if put in today, will pay for itself and be paying a handsome profit, and such improvements as may be developed may be installed later, their cost having been earned in advance.

Filtration engineers are at present rather sharply divided into two schoods of thought and practice—those who believe in a thin cake rapidly

formed and removed, and those who prefer a thicker cake formed more slowly. It seems likely that the continuous cord strippers will remove a thinner cake than can be successfully taken off by scrapers. The writer will not attempt to express a preference for either idea, since both are in commercial operation. Possibly in the end a compromise will be agreed upon in the matter of cake thickness.

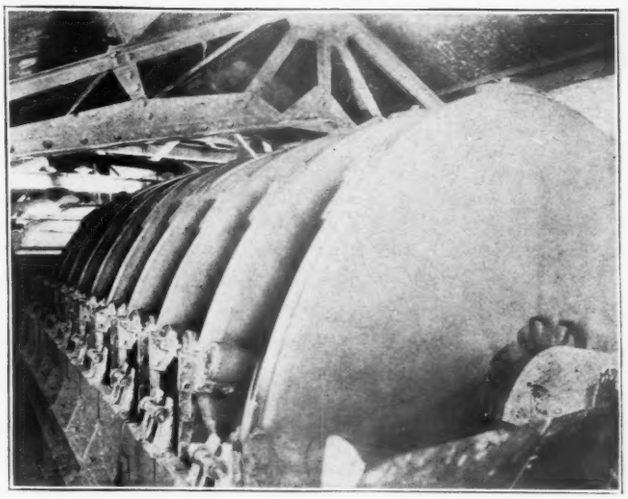
Influence of Filter Speed

It seems to be fairly well established that the layers of cake next the cloth, which are the first ones deposited, are built up more rapidly than are the later layers. Using a specific instance, the capacity of a filter in terms of barrels per square foot in unit time was increased 50 per cent by doubling the speed of the filter. In actual practice, this fact must be interpreted in connection with the type of filter, space required for its installation, and ability to strip off the thin cake.

The amount or percentage of water left in the cake depends both on the nature of the slurry and on the treatment it receives during the filtering operation. In general, and for the purpose of estimating possible savings, it may be assumed that the water in ordinary slurries may be reduced to 18 or 20 per cent, the lower figure being for the more granular material. Marl slurries may be reduced to about 24 per cent water, the reason being explained presently. It is decidedly not true, however, that equal tonnages of these various materials per square foot of filter area can be reduced to these percentages of moisture in the same time. On the contrary, it is well known that a slurry made of limestone and fine-grained clay or marl and clay may require two and one-half times the filter area that is needed by a slag-limestone mixture for the same time-tonnage output.

It is for this reason, and because the behavior of a given slurry on a filter can be only approximately arrived at from its composition, that the filter manufacturers very wisely approach each proposed installation as a problem for individual study, since experience has shown that no two are exactly alike. They make use of a device known as a "test leaf," which has been developed as the result of experience in other industries. It consists of a vacuum chest, one side of which is covered with the filtering medium to be used. A small batch of slurry may be filtered on this, using a known vacuum, and the process of building the cake may be studied at no great expense and under laboratory conditions. The results serve as an excellent basis for determining the size of the machine to be installed and the probable behavior of the slurry on it.

The consistency of the average filter cake is about that of the mud pies that we played with as children, or perhaps a little drier. It has lost much of its cohesive power, especially if it contains little or no clay, and because of this the filtering operation ends in practice with a phenomenon known as cracking. The cake, usually less than an inch in thickness, develops irregular cracks over its surface, through which air rushes and lowers the vacuum to a point such that no more water is withdrawn.



American Continuous Disc Filter

It has been found that if the cake can be mechanically agitated, rubbed or smoothed over, the incidence of cracking may be delayed, and a small additional amount of water may be withdrawn. This may reduce the moisture in the cake by from 2 to 4 per cent, depending on the nature of the slurry.

One filter manufacturer uses a soft wiper under which the cake drags while drying, and also insures uniform performance by means of a continuous canvas riding belt that rests on the cake during drying, and runs under rollers that rest on the cake. Another maker compacts the cake by slapping it a number of light blows with a strip of soft rubber. These operations may be imitated on the test leaf, and a good idea of their efficacy in any particular case may be had.

Slag Slurry

It has already been stated that the first slurry filter was put to work on a slag-limestone mixture. This was about four years ago, and most of the "bugs" have been worked out of the problem, at least so far as concerns that particular material. Perhaps this choice was fortunate, for slag slurry is the most granular of all, and requires the least filtering area. It contains no colloidal material that would tend to clog the cloth.

(To be Continued)

Pass it On

To save time and labor is the surest way to cut costs in our industries. The best way to sharpen your wits is to use them. If you have figured out a better method of doing a job, pass it on to your neighbor.

Recent Developments in the Chemistry of Cement Manufacture

DR. HANS. KUEHL

THE great cement secret is hidden in the mass of cement, sand and water which undergoes setting and hardening. The tendency is to regard the hardening of cement as a colloid-chemical shrinkage of a swollen (that is hydrated) mass of gel. The basic mechanism of hydraulic hardening may be divided into two principal processes, according to analogy with the hardening of fish glue, as follows: first, the formation of a mass of gel from cement and water at the surface of the cement particles, and second, the shrinking of this mass of gel through internal suction-filtration. This latter action takes place due to the fact that the still undecomposed particles of cement extract water from the gel mass formed on the surface of the particles and cementing them into a solid mass, this abstracted water serving to hydrate the unchanged portion of these cement granules.

Chemistry has always had an important connection with the cement industry. The chemist has been of material assistance to the cement maker in the past and will likely be of even greater aid to him in the future. The cement industry of America will be much interested in reading this following article, which is composed of the salient parts of an address which Professor Kuehl delivered before the recent meeting of the German Chemical Society in Berlin. In it he describes some important chemical details of cement making and use and also tells of some of his own researches into the chemistry of cement. The reader who is interested will find the entire article in Tonindustrie Zeitung 1928, pages 1817-20.—*Editor.*

What is the character of these gel masses which are formed throughout the cement by combination with water? That is the principal question. The answer is that we are here concerned with two substances, which are very different from one another from a chemical standpoint, but very much like each other from the physical or the cement-technical standpoint. These are namely calcium hydrosilicate in the siliceous cements and aluminum hydroxide in the aluminous cements. It is important that a careful distinction should be made between these two types of cement in studying their hardening mechanisms.

As far as super-cements are concerned, these can be manufactured in a purely technical manner only when suitable raw materials are available and the cement mill is provided with all the necessary modern equipment. Such a state of affairs does not always exist, and in such cases chemistry steps in and lends a hand. Thus for example it is possible to add certain ingredients to the raw cement mixture which will make it suitable for this purpose, and furthermore, various catalysts may be later added to the ground cement which will increase its reactivity.

For many years, the cement industry has not been able to hold strictly to the rule that limestone and argillaceous rock must be combined in correct proportions in order to make cement. It was found early that one cement rock is quite different from another and that in the artificial correction of the composition of a few suitable cement rocks was afforded an important opportunity for improving the quality of the cement. The best grades of portland cement are obtained when cement rocks of abnormal compositions are used. This means that particularly silica-rich and particularly silica-poor cements are obtained. The means of obtaining these results consists of the use of quartz, sand or flint on the one hand, or bauxite, iron ore or certain slags on the other hand. These materials are mixed with the raw cement before burning. When the proportion of silica is reduced, then particular attention must be paid to the ratio of alumina to iron oxide, for when the alumina content is too high, then cements will set too rapidly, which is a serious matter in their use. However, cements, which contain a low silica content, possess a certain advantage over all other cements, for the reason that they do not have to be ground so finely as the other cements in order to obtain high initial strength. The reason for this is that the aluminates, which are present in such cements in larger proportion than usual, are by far more reactive than the silicates, which form the principal ingredients of high silica cements.

A Common View

The viewpoint is commonly held that for the most part further progress in the manufacture of rapidly hardening portland cements must be looked for in the sintering process. The temperature range, within which sintering plays a part with the aid of certain fluxes, and the physical influence of the duration of heating and cooling on the structure of the burnt clinker are still problems which have not yet been solved in all their details. The author believes that a further investigation and study of these processes, which are unfortunately so difficult to understand, will be of essential importance of improving the practical methods of manufacturing portland cement.

Catalytic Agents Improves Quality

While it has been common practice to investigate the energy of hardening of which portland

cement is capable of undergoing by examining the burnt clinker, the newest investigations which have been made along these lines have indicated that it is possible to improve the quality of the cements by the addition of certain activating substances after the burning process and during the grinding of the clinker, these substances being known as catalysts. The author has investigated during the past year all anions and cathions, which are easily available, from the standpoint of their effect on the rapidity of hardening of portland cement. He has found that at times quite surprising effects are obtained. Thus for example the initial strength of a cement can be increased from 58 kilograms per square centimeter to 238 kilograms per square centimeter by the addition of approximately two per cent of calcium bromide. Nevertheless this fact is of theoretical interest only, for the reason that the price of bromide salts is too high to admit of their use for such a purpose. Still, this is a very interesting phenomenon, for it shows that very potent effects can be obtained just by the addition of substances to the cement.

It is true that up to the present time no use or very little use has been made of this knowledge in the practical manufacture of portland cement. The reason for this is found in the fact that up to the present time it has not been possible to formulate rules for the use of these catalysts which can be reproduced. Cements differ from one another in such a marked manner that it is possible only in a very approximate manner to deduct the nature of the behaviour of a cement from that of another cement. It is just in the application of catalysts that a basic rule or rules are wanting on which to build up a practical use of these substances. Only a few technical empirical facts are known and these have naturally not yet enabled the investigator to formulate any rules upon which the practical use of catalysts in the manufacture of cement could be based.

As far as the other types of siliceous cements are concerned, such as the blast furnace slag cements, the author merely wishes to point out that here also a marked improvement in the quality of the cement can be obtained by means which do not differ basically from those that have been found to be very useful in the portland cement industry. Attention must, however, be paid to the aluminous cements which may be considered to be the direct opposites of the siliceous cements. Just in order to emphasize in the reader's mind the great difference between these two types of cements, it is mentioned again that the hydraulic binding agent, or rather the ingredient which is responsible for the hydraulic properties of the cement, is in the siliceous cements calcium hydrosilicate, while in the aluminous cements it is aluminum hydroxide. There is still another essential difference between these two types of cements, for the siliceous cements consist of high lime, while the aluminous cements consist of low lime compounds of the hydraulic factors, silicic acid, alumina and iron oxide. We have to assume two or three basic compounds of lime in the siliceous cements but in the case of the aluminous cements only unibasic compounds of lime. The following equations are useful in indicating the actual difference between the two cements:

$$3CaO.\ SoO_2 + xH_2O = 2CaO.\ SiO_2.\ y\ H_2O + Ca(OH)_2.$$

$$3(CaO.\ Al_2O_3) + xH_2O = 3CaO.Al_2O_3\ y\ H_2O + 2Al_2(OH)_6.$$

These two equations of reaction, which are represented, it will be understood, by approximate formulae only show us that in the hydration of siliceous cements we are concerned with the degradation, and in the hydration of aluminous cements with the building up of high lime compounds of the reactive ingredients with simultaneous liberation of calcium hydroxide in the first instance and of aluminum hydroxide in the second instance.

Manufacturing Methods Differ

Just as different as the reactions of hydration are the methods of manufacture and the properties of siliceous and aluminous cements. The manufacture of aluminous cements is accomplished by the melting down of coarsely ground raw materials, limestone and bauxite and subsequent fine grinding of the cooled mass. From a technical standpoint aluminous cements are distinguished by their quite extraordinarily high energy of hardening. Hardening is complete within twenty-four hours, and under certain conditions within eight to twelve hours, while the strength of good grades of portland cement is developed only after twenty-eight days. In contradistinction to this extraordinary hardening energy of aluminous molten cements stands the commercial disadvantage, which is highly in favor of the ordinary types of cement.

Due to the comparatively rare occurrence of deposits of the principal raw material, which is used in the manufacture of the aluminous cements, namely bauxite, and due to the technical difficulties that arise in the manufacture of these cements, their price is considerably greater than those of the siliceous cements. In spite of this fact the consumption of aluminous cements is rapidly increasing, and this is so not only because of the great rapidity with which the aluminous cements harden, but also because the cement is resistant to chemical influences, such as sulphate containing water in particular, much more resistant than ordinary portland cement.

Cement and Chemistry Related

One of the most interesting features of the modern cement industry is its connection with the chemical industry. The cement industry has been

able to use the by-products chemical industries to good advantage in the manufacture of portland cement and the like. It is hardly necessary to call the attention of the reader to the relation between the iron and steel industry and the cement industry and to the use of blast furnace slag in the manufacture of slag cement.

It is also interesting to note the connection between the sulphuric acid industry and the cement industry. Reference is made here to the German process of manufacturing sulphuric acid from gypsum with the recovery of portland cement as a by-product.

(This process has no practical interest to the American manufacturer, for we have sufficient sulphur for making sulphuric acid without going to the trouble of using gypsum. *Trans.*)

There is a third possibility of an important connection between cement and chemical industry and that lies in the recovery of aluminous cement in the manufacture of phosphate fertilizers.

(Inasmuch as one of the chief drawbacks to the use of aluminous cement has been its high price, the possibility of obtaining a cheap aluminous cement in this fashion should receive careful attention. *Trans.*)

Aluminous Cement from Phosphate Rock

It is possible to melt down the crude phosphate rock with the addition of coal and bauxite and to set free the element phosphorus in this fashion. The latter is then worked up into phosphoric acid, and while this is being done, an ignited residue is obtained during the reduction of the compound formed between lime of the phosphate and the added bauxite, which residue has a composition that is principally that of an aluminous cement. If this process appears to be very simple technically at first glance, it must, nevertheless, not be forgotten that there are certain technical difficulties connected with it, for the reason that the composition of the molten residue can very well differ materially from that of an ordinary grade of molten cement. One important consideration is that phosphides will be present in this residue, and it has been found that these phosphides are more potent in their action on the properties of aluminous cement than are sulphides on the properties of portland cement. Furthermore, the silica content of such an aluminous cement may well be very high and hence the hardening of the cement will be retarded. There does not appear to be any real difficulty in carrying out this process in such a manner that a good grade of aluminous cement can be obtained. What the commercial feasibilities of the process are is of course a different matter and depends largely upon local conditions.

The author also calls attention to the fact that it is possible to work up the lime muds and slimes which are obtained in the manufacture of lime-nitrogen and calcium carbide. Nevertheless, there is but little question that such an undertaking would be of little importance at the present time. The interesting point is that a possibility exists of making cement from these residues.

There is still another important relation between the cement and the chemical industry, and this is one in which all cement manufacturers should be interested. Cement finds considerable use in the chemical industry in the construction of apparatus for storing chemicals and also for carrying out chemical reactions. This is particularly true as far as supercements are concerned, that is slow-setting but rapidly-hardening cements. Such cements are employed for many purposes where the conditions of use are very severe, as for example where the structure or apparatus are subjected to severe weather conditions, for building pits where the cement must dry out under severe difficulties. Aluminous cements are also very useful for work which must harden quickly, such as foundations for machines and the like.

Action of Ammonium Salts

Attention is called to the highly corrosive action of the ammonium salts on cement or rather concrete. Certain of these salts will corrode cement when they are in the solid state. Thus in the case of high-lime cements, an interchange of bases takes place with the ammonium salts. Those salts that are particularly active in this way are ammonium chloride and ammonium nitrate. Less active are ammonium carbonate and ammonium oxalate. Even though the aluminous cements are low in lime and after setting do not contain free lime, nevertheless, they are also subject to decomposition by the action of ammonium salts.

As a general rule, alkali salts are not dangerous, provided that they do not contain an active anion. Nevertheless, corrosion of the cement is caused by most magnesium salts. Here again an interchange of bases takes place just like in the case of the ammonium salts. The reaction takes place slowly and it appears that low-lime cements and particularly aluminous cements are resistant to the action of the magnesium salts. It is recommended that aluminous cements should be used for this purpose.

Sulphates are more restructive of cement than any other anion. This depends on the formation of a double salt, containing water of crystallization, between calcium sulphate and calcium aluminate. This compound is known as calcium sulphoaluminate or calcium-aluminum sulphate. The presence of a high-lime and a high-alumina content is necessary for the reaction to take place. It, therefore, follows that the richer the cement in lime and alumina, the greater the danger of decomposition. The aluminous cements appear to be entirely resistant to the action of sulphates, even though they contain a large amount of alumina, but then again little lime.

Accounting Practices for Cement Mills

By J. J. BERLINER

THE organization of a portland cement plant resolves itself into three general divisions; quarrying, manufacturing, and selling. The function of the quarry division is the production of the raw materials, which includes stripping, clearing, drilling, blasting, and the transportation of these raw materials to the mill. The manufacturing division includes all operations from the storage of the raw materials to the production of the finished product; while upon the selling division is imposed the task of marketing the manufactured product, at a price which will return a fair margin of profit upon the investment. In order that the above divisions may function properly, it is highly important that an adequate accounting department be maintained to guide the executives at the head of the enterprise in administering, financing, and marketing the product. The organization chart, No. 1, presents the various officials and the functional heads and divisions of a cement plant.

Legal Status

The manufacturer in the cement industry, as in many other industries selling the product in returnable containers, stipulates in his sales contracts that cloth sacks must be paid for with the cement, and agrees to repurchase, at a certain price per sack, from the purchaser of the cement, such of the cloth sacks as may be returned in fit condition for further use. The sales contracts also stipulate that the customer must pay the freight on the returned empties, and that the cement manufacturer's count and inspection shall be final in determining which sacks shall be repurchased. Therefore, when a barrel of cement in cloth sacks is sold to a customer, the transaction is not complete with the invoicing and delivery of the cement; there still remains to be discharged by the cement manufacturer a vital and essential part of his sales contract.

Financial Records

The financial records used by an enterprise in the manufacture of portland cement consist merely of the usual cash book (which may be divided as to cash receipts and cash disbursements), purchase journal, general journal, sales record, sack record, accounts receivable ledger, accounts payable ledger, and general ledger. These records call for no special comment as the functions of each, and the course of entries from one to another, and general relation each bears to the others and to the system as a whole, are presented in diagrammatic form in chart 2.

Cost Records

Cement manufacture is what is known as a continuous process on mass product. In the course of travel of the basic materials from the quarry to the merchantable product, there are, however, at least three points where more or less of an accumulation of the partially processed mass occurs. This may happen through seasonal requirements—as the quarrying process may be largely performed before the rigors of winter set in—or it may be a matter of labor conditions in different departments; or, yet again, a matter purely of antecedent preparation against ill effects from "feast or famine" conditions obtaining in any of the successive departments. Irrespective of the reason, the facts are that certain processed material must be carried on inventory; sane and rational accounting requires that these inventories be intelligently costed, and placed under adequate accounting control.

The principal record utilized to collate the cost of the finished product is the cost ledger, which is divided into two general sections, viz the quarry section and the mill section. Under the quarry section provision is made for Quarry No. 1, and Quarry No. 2, with such others as the individual plant has need for. To these accounts are posted all the sundry costs involved in the production and transportation of the raw material to the mill or to storage areas.

Under the mill section, provision is made for recording all costs incident to the grinding and burning operations involved in cement production. These operations include raw grinding, clinker burning, and clinker grinding, and, beyond this, the costs involved in storing raw material and partially processed material, the largest volumes of which consist of raw material No. 1, raw material No. 2, and clinker. Each of the latter should have a cost record, similar to that of the processing departments, wherein may be accumulated any and all charges due to the expenditure of money, or the flux of time, with its incident of proportional absorption of rent, interest, and other overhead items.

The various accounts in the cost ledger receive their entries severally from the cash book, purchase journal, payroll register, and expense summaries, all of which are shown diagrammatically in Chart 2.

Production Costs

In a continuous process the costs obtained are, of necessity, average costs over a given period, there being a summation of the cost of each individual

department and, subsequently, a division of this cost over the yield of the department, expressed in terms of the unit of production. The semi-finished product in the cement business is clinker, and this is figured in barrels, in the same manner as is the merchantable cement. The accounting for the cost of the product in its various stages of manufacture, from the inception of the raw material to the finished product, is shown in Chart 3. A separate column may be added to the chart, to show the cost of coal used in the drying and burning process, instead of including this item of expense in overhead. This information is important, for the reason that it represents 25 to 30 per cent of the cost per barrel of cement and, in the opinion of cement men, this is one of the most important items in the manufacture of cement.

This article considers the quarrying of two raw materials, the dry process of mixing and grinding, and the use of coal for fuel.

The most simple and broadly effective plan of determining the manufacturing costs of cement is on the basis of monthly production. This requires that each department shall be charged with all material and all labor used, and all direct expense incurred during the month; and, beyond this, with a just and accurate absorption of general overhead costs.

At times, the necessity is felt of having a general averaged cost rather than that based on one month, in which case a three, four, six, or twelve months' average may be taken, by summating the costs of the desired period and dividing the result into the yield of that period.

The ultimate object of determining correct production costs is to arrive at the cost per barrel of finished cement. To do this, it is of prime importance that correct inventories be maintained at each stage of the process. This fact may be emphasized in the case of raw materials. It is not

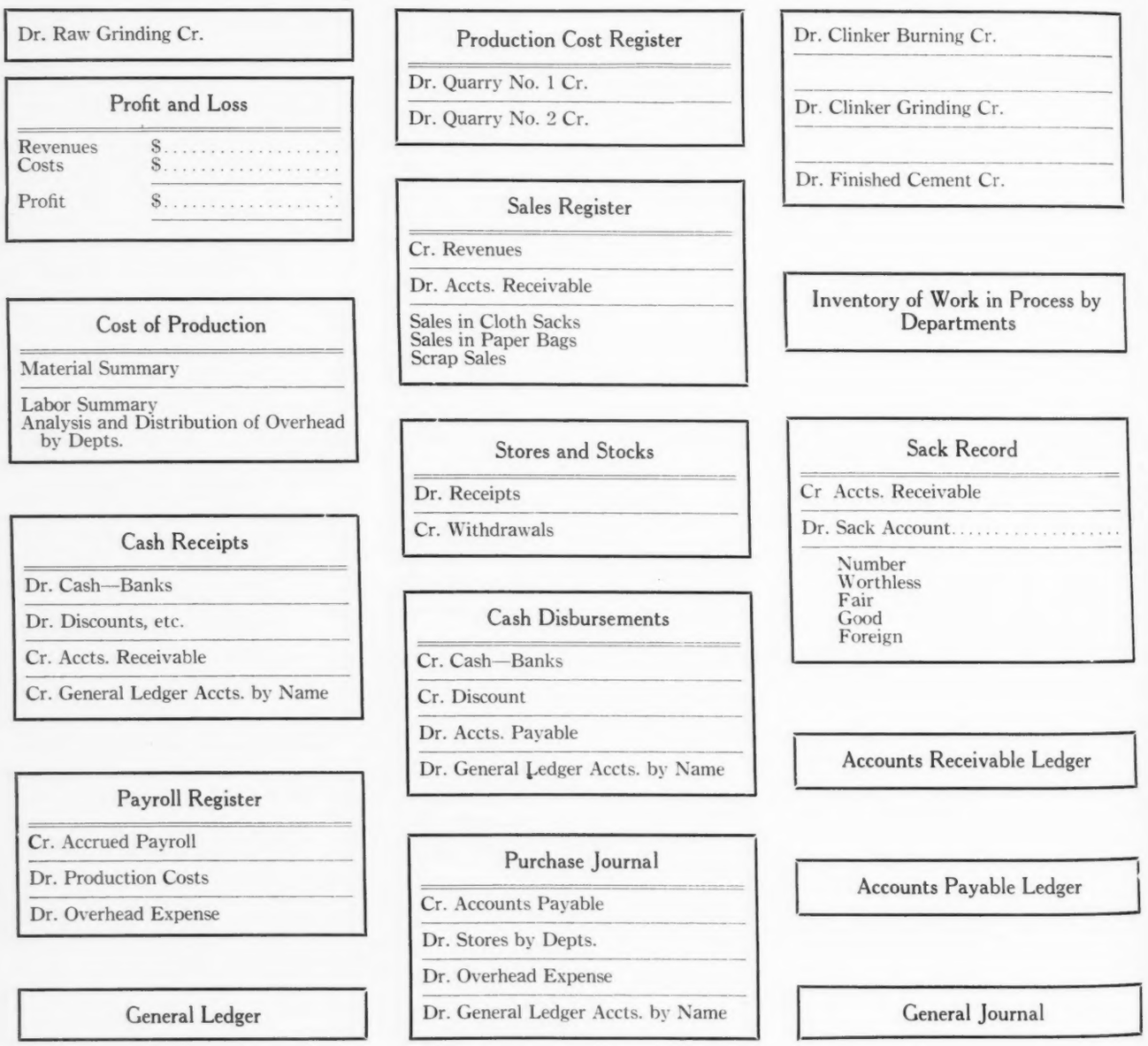


Chart 1—Accounting Books and Records, Cement Manufacturing Company.

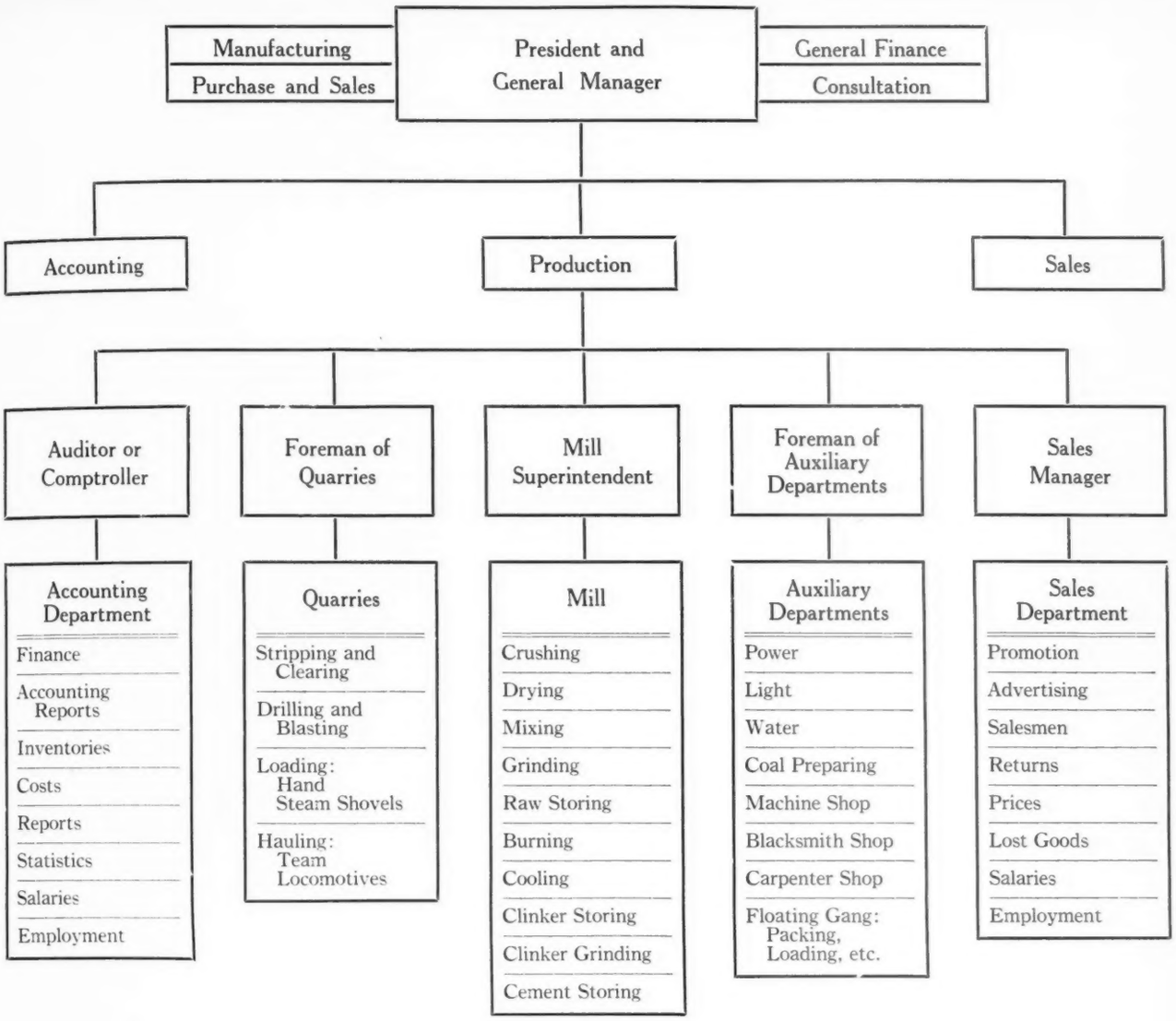


Chart 2—Organization, Personnel and Departments

unusual for a cement manufacturing company to quarry its entire year's consumption of raw material during the summer months; and, obviously, it would be wrong to charge the clinker costs for the summer months with the cost of producing the entire year's supply of raw material. It is essential, therefore, that separate costs be maintained for each of the raw materials quarried, and that the clinker cost records be charged with only the amount consumed during the month.

Parallel conditions obtain with clinker costs, inasmuch as the clinker inventory may fluctuate widely from time to time, since in some months more clinker is likely to be produced than is ground into cement, while in other months the quantity of clinker produced will be much less than the quantity consumed. It is, therefore, necessary to have each step in the production routine stand squarely upon its own cost basis, and to have its own individual unit cost determined, so that subsequent routines may bear only their own just costs. Clinker costs, when known, may be used for inventory valuations, and also for subsequent processing; conversely, inventories cannot be intelligently priced unless comprehensive costs are known; hence it is imperative to carry the going inventories of the various processing steps, unless false showings are to result.

Overhead Expense

The correct distribution of overhead expense over the various producing departments of a cement plant is highly essential, if it is desired to ascertain reliable departmental costs, or the cost of inventories at different stages of the process. Many items of overhead expense can be directly allocated to the producing departments and, where such procedure is possible it should be followed. The remaining items which cannot be allocated directly must, of necessity, be prorated on some arbitrary basis. The various producing departments should also bear their pro rata share of the general and administrative expense according to the amount of supervision exercised over each and

the benefits derived from the administrative division.

Each of the auxiliary departments should bear its pro rata share of the general overhead and administrative expense. When the total expense of these departments has been determined, the share of each should be prorated over the various producing departments according to the benefits derived.

Returnable-sack Accounting

Cement (with the exception of a very small percentage which is sold in paper bags and bulks) is sold for shipment in cloth sacks. Cement companies differ in their theories as to how these sacks should be disposed of to the customer. Some companies sell them outright for whatever happens to be the price that they had set for such sale; other companies retain ownership of the sacks, or, in other words, lease them to the customer at an agreed-upon price. In either case, however, whether sold or leased, the agreement is that they shall be returned to the cement company at the same price the customer paid for them, or he is required to make a deposit, which is refunded when the sacks are returned.

At the present time the charge for cloth sacks, whether sold or leased has been reduced to around 10 cents per sack, which the customer must pay, and which is refunded when he returns sacks within a reasonable time, in good condition subject to the count and inspection of the cement company. The system of accounting for returnable sacks, and the fact that in the cloth sack item, no profit or loss is incurred until the sack has disappeared in service and will not be returned, will be explained.

For illustration, take a company which leases its sacks. If the price of sacks sold by the manufacturer to the cement company is 10 cents each, the charge to the customer is 10 cents each, and the amount refunded to the customer when sacks are returned by him is 10 cents each, hence the question is a comparately simple one; but this condition has never existed and probably never will. Assume that the average inventory price of all sacks on hand in the cement company's inventory is 15 cents per sack, and that the charge to the customer is 10 cents per sack. The following general ledger accounts should be opened: Sack Inventory, Sacks in Customers' Hands, Customers' Sales Ledger, Customers' Sack Deposit, Profit and Loss on Sacks Developed Useless, and Profit and Loss on Sacks Destroyed in Service.

All old and new sacks in inventory should be charged to the Sack Inventory account at an average price, which, for example, will average 15 cents per sack. As sacks are shipped, the first entry is a transfer by journal entry from the Sack Inventory account to the Sacks in Customers' Hands Account at the average price of 15 cents per sack, which is the average inventory value. This entry is made largely for convenience, because it enables one to ascertain readily how many sacks are in the hands of customers at any given time.

At the end of the month (because in the customer's invoice there is a charge of 10 cents for each sack), in the recapitulation of the sales journal, the total of the invoice including the 10 cents is charged to the Customers' Sales Ledger account, while the credit is split to Cement Trading account, or in some companies to the Profit and Loss Account and the Customers' Sack Deposit account. The latter account apears on the balance sheet as a distinct liability, and should represent 10 cents for each cloth sack shipped and outstanding.

This liability account stands until the sacks are returned by the customer when a specific liability to the individual customer should be entered on the books, or a check or draft drawn in favor of the customer and charged to the general liability account, Customers' Sack Deposit account. A further entry is then made, charging back to the regular Sack Inventory account and crediting Sacks in Customers' Hands with the number of sacks returned at their inventory value.

(To be Continued.)

Statement of Production Costs								Yield Credit							
Departmental Accounts	Date		Material, Dr.			Labor, Dr.	Overhead, Dr.	In Process				Inventory			
			Quantity	Price	Amount	Amount	Amount	Unit	Quantity	Price	Amount	Unit	Quantity	Price	Amount
Quarry Section: No. 1 Cement Rock	8	30	50,000 tons Depletion	0.10	$ 5,000.00	$10,000.00	$10,000.00	Tons	30,000	0.50	$15,000.00	Tons	20,000	0.50	$10,000.00
Quarry Section: No. 2 Limestone	8	30	30,000 tons Depletion	0.066	2,000.00	3,000.00	2,500.00	Tons	20,000	0.25	5,000.00	Tons	10,000	0.25	2,500.00
Mill Section: Raw Grinding Department	8	30	30,000 tons	0.50	15,000.00	10,000.00	13,650.00	Barrels	110,000	0.397	43,650.00	Barrels			
		30	20,000 tons	0.25	5,000.00										
Mill Section: Clinker Burning Department	8	30	110,000 bbl.	0.397	43,650.00	17,000.00	42,250.00	Barrels	105,000	0.935	98,222.50	Barrels	5,000	0.935	4,677.50
Mill Section: Clinker Grinding Department	8	30	105,000 bbl.	0.935	98,222.50	3,100.00	28,645.00	Barrels	100,000	1.237	123,779.00	Barrels	Bin Cost	of Ce	ment
Shipping:	8	30	100,000 bbl.	1.237	123,779.00										
Sack Cost		30		0.15	15,000.00	2,700.00	1,850.00	Barrels	100,000	1.435	143,560.00	Cost of	Sales		
Packing and Loading															
Sack Handling															

Chart 3—Statement of Production Costs, Cement Mill.

Pulverized Coal for Cement Burning

BY CHARLES LONGENECKER

AMONG some purchasers of coal for cement burning, there is a misconception as to the value of the various grades. This misconception is due to the fact that coal is sometimes purchased solely on a B.t.u. basis with no consideration of its physical or chemical characteristics. One would certainly not purchase an automobile simply because its gas consumption is low. In fact, before making a selection, the wise buyer will make a thorough investigation into all the salient features of a machine. The same manner of investigation should be conducted in the selection of a coal, especially when the output of a cement plant is, to a very considerable extent, dependent on the proper heating of the kilns.

The fallacies of buying coal on the basis of receiving so many B.t.u. for a cent and on no other specification are: that the particular coal may be hard to pulverize; that it may have an ash with a low point of fusion; that it may have a low volatile content, or that it may have a comparatively high percentage of ash or moisture. The indices which determine the most satisfactory fuel for any heating operation, whether it be for firing cement or lime kilns, boilers, or furnaces of any description, is the quality of the material heated and the economy of the process. These are points on which costs can be based with certainty for they are the result of practice, not of theory. Therefore, should one desire to choose a coal, it would be advisable, before signing a contract for a year's supply, to burn several coals over a period of sufficient length to demonstrate the fitness of each. This plan is frequently followed in plants that have been in operation for some years, but in which the results obtained are not deemed satisfactory. The point that must be borne in mind is that low cost of operation and high quality of product are the objects sought and whether these are secured by a high or low priced coal is immaterial. A high priced coal may prove more economical than a cheap coal.

The chemical elements in coal are carbon, hydrogen, sulphur and oxygen. Of these elements the first three, when combined with oxygen, create heat. Sulphur is not desirable though, as it is found in small quantities and is, to a large extent, combined with iron. A small portion of the sulphur burns to SO_2; the remaining portion passes into the ash. When a coal contains a high percentage of sulphur it indicates an ash of low fusion point and one that will easily clog grate bars in hand-fired furnaces. Carbon exists as fixed carbon and in combination with hydrogen in the volatile matter. When it burns it is dissociated from the

Charles Longenecker

hydrogen and unites with oxygen to form CO and CO_2. The hydrogen also unites with oxygen and forms H_2O (water). Each of the reactions mentioned —the formation of SO_2, CO, CO_2, and H_2O—is known as an exothermic reaction, i.e., heat-creating. Another interesting point in the burning of coal, and one that is frequently overlooked, is that it burns as a gas. In fact, any fuel, before combustion actually occurs, is converted into a gas; in the gaseous form it then burns to the final condition of complete oxidation. Thus, when coal is burned in a cement kiln the fine particles should be fed into the kiln in such a manner that each particle will be surrounded by air from which the elements in the coal can obtain oxygen. As the particle of coal is heated, it first is coked and, in changing its physical form, the volatile matter is driven out and immediately burns. The grain of coke then burns, but the burning of the volatile matter should create enough heat to cause the kernel of fixed carbon (coke) to gasify and undergo combustion. It is for this reason that a coal low in volatile matter is difficult to burn. Anthracite, for instance, when pulverized to the same fineness as is usual for bituminous coal, is burned with much difficulty. However, if it be ground much finer, it readily burns. For rapid burning, a coal should be powdered very fine. Of course in a cement kiln the length of travel of the coal stream is great enough to permit the coal particles to find oxygen before entering the stack; consequently there is small likelihood of unburned coal passing away even if the dust is not so fine. Hence to promote rapid combustion one should select a high volatile coal and grind it very fine. The volatile matter should not be below 30 per cent; it should preferably be about 35 per cent. If pulverized so that 95 per cent will pass through a 100-mesh screen, no trouble will be experienced.

There are many companies that have been burning cement for years, and that experience no trouble in firing their kilns. But how many such companies are securing the highest efficiency in their kilns? As long as one goes along day after day without any kicks from the operating force nor any complaints from the purchasers of the cement produced, there is the probability of becoming too complacent. In this condition a plant superin-

tendent may be suddenly confronted by the fact that his competitors have stepped ahead of him. He should, accordingly, keep well posted on improvements in pulverizing and burning coal and he should not wait for others to make improvements but should make them himself. This fact is mentioned because today research is conducted very extensively in many plants, and equipment is being manufactured by which substantial economies can be obtained. It certainly would not be amiss for cement manufacturers to investigate the practice followed in modern boiler plants burning powdered coal, for while the procedure followed is radically different, nevertheless there is enough similarity to warrant an inspection of the apparatus employed.

The present is indeed an opportune time for the determination of the most suitable coal for one's plant. Coal today can be purchased at a comparatively low price and for this reason experiments can be conducted with advantage. As previously mentioned, a purchaser of coal should not be governed in his selection of a coal by price alone for the reason that a coal higher in price than the one being used may perform the same service at a less expenditure in pounds of coal.

Cement burning differs materially from most other heating operations in that the process is very uniform. The clinker passes out of the kiln at a constant rate per hour and the coal is fed in at a constant rate; there are no fluctuations except those due to imperfections in the mechanism which controls the flow of these materials. Under such conditions the heating of the kiln is rather simple, but it may be improved. Any change in the quantities of coal or stone fed into the kiln affects the flow of heat so that equilibrium must again be restored before correct heating conditions will be re-established. To prevent fluctuations, automatic regulation of the flow of coal and of air is recommended. Of course the amount of coal and air admitted must be maintained in proper proportion to the stone delivered to the kiln.

The burning of cement has always been considered a process which can best be controlled by skill rather than by instruments, and the simplicity of the process gives favor to this idea; however, those industries dependent upon heat to carry out their processes are giving much attention to the control of temperature by suitable mechanism.

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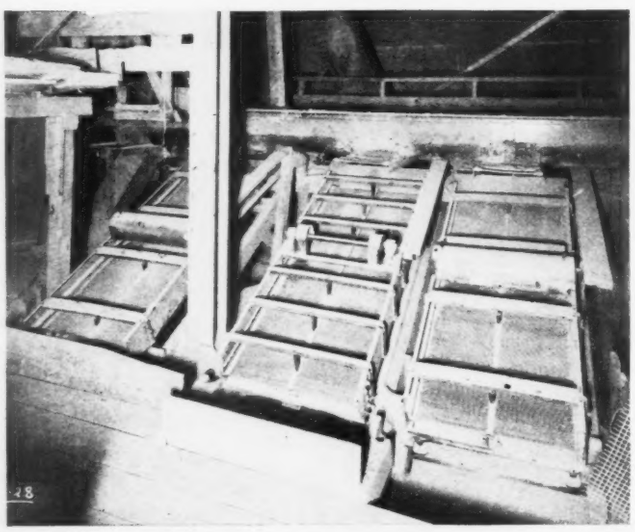

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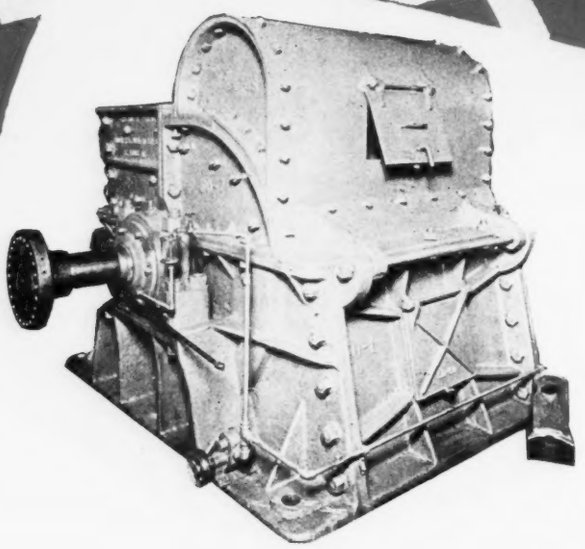

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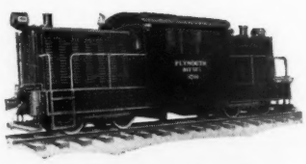

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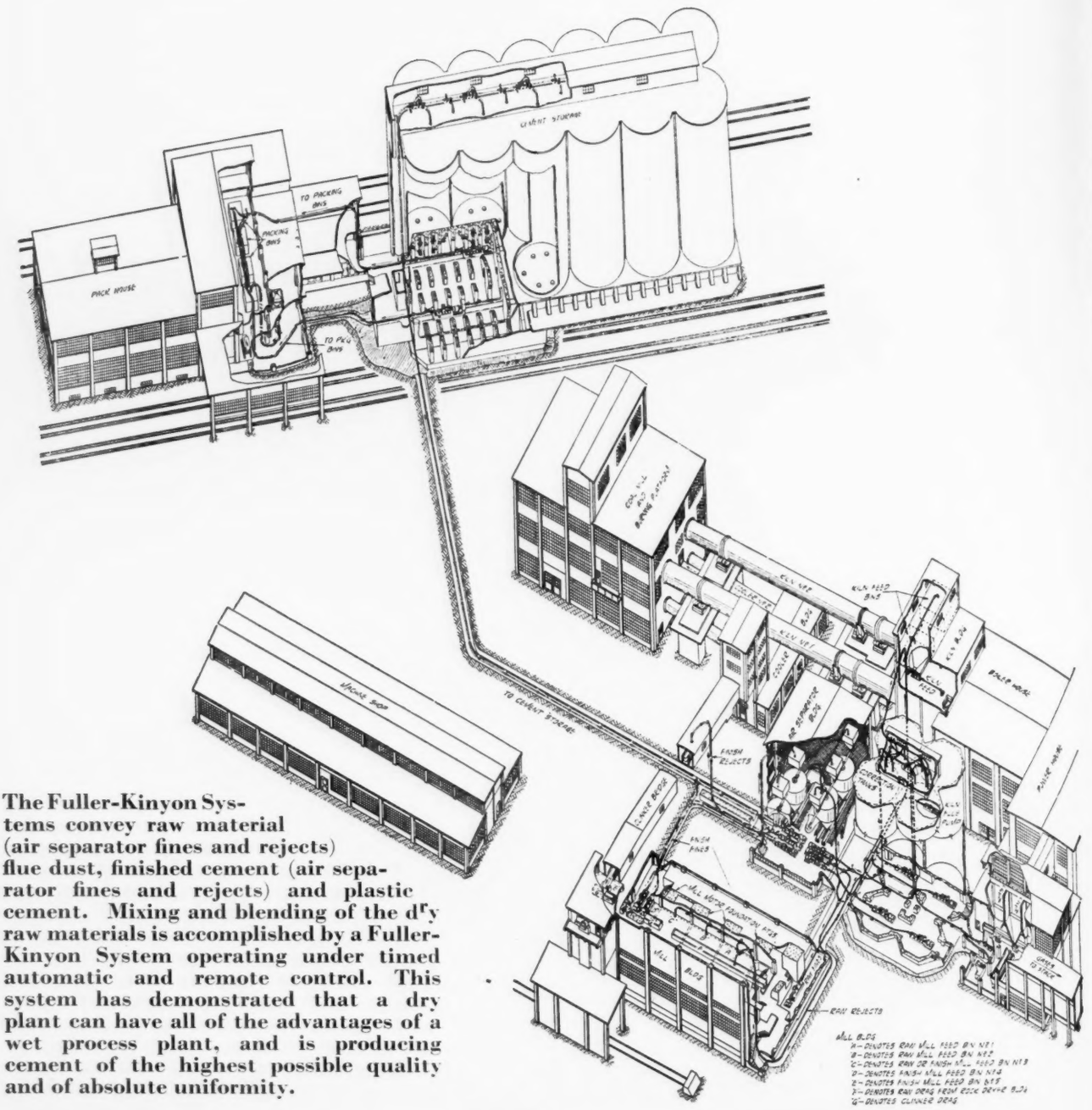

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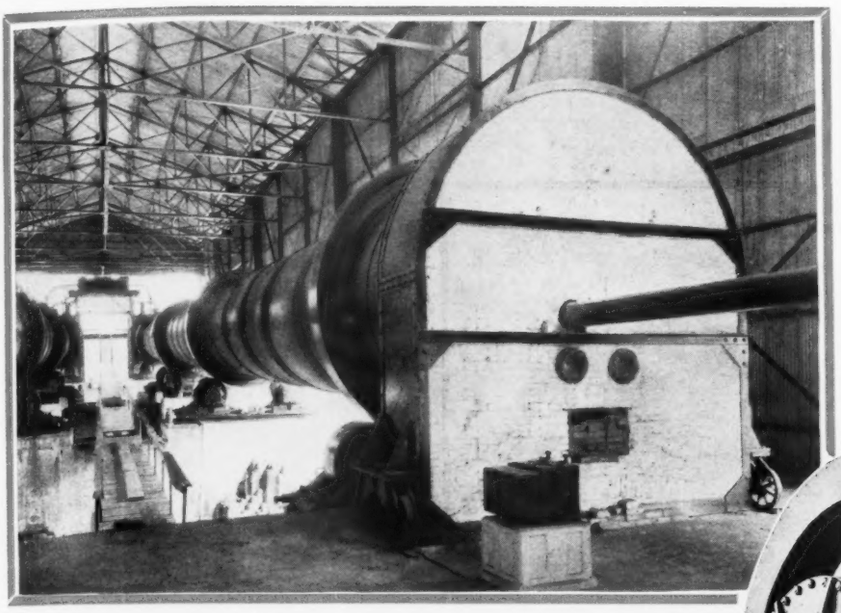

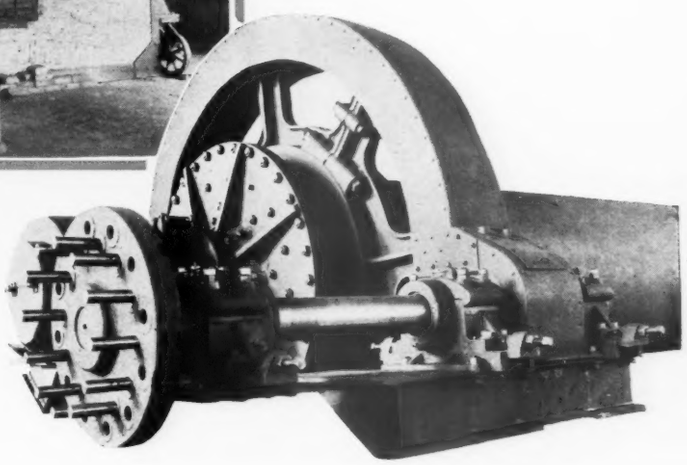

Cut Horse Power and you Cut Costs

Here are two kiln installations at the Volunteer Portland Cement Co. Plant, Knoxville, Tennessee, showing the firing end of one kiln with portable control stand and controllers for slurry-feed and pulverized coal-feed motors. Self-lubricated single roller bearings are used, and the *horse power necessary to run these kilns is reduced to an almost unbelievable figure.* In addition to the reduction of horse power, there is an advantage in ease of adjustment of rollers, and a reduction in attention because of the lubricating feature.

Note the massive construction of this recently installed tube mill, drive side of which is shown. Note also the absence of bolts in the shell to hold the lining in place. Vulcan lining employs bolts only at three or four points throughout the length of the shell, and very few at these points.

Complete satisfaction with lower costs, regardless of size or situation—that's Vulcan. Our Engineers are at your disposal—they build kilns for *any* purpose, to suit *any* condition of service.

VULCAN IRON WORKS
Wilkes-Barre, Pa.

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VULCAN of WILKES-BARRE KILNS

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Geology of Non-Metallic Minerals ..... E. D. Roberts
Some Factors in Plant Design G. B. Massey and H. W. Munday
Drilling and Blasting ..... R. N. Van Winkle
Stripping Overburden ..... G. B. Massey
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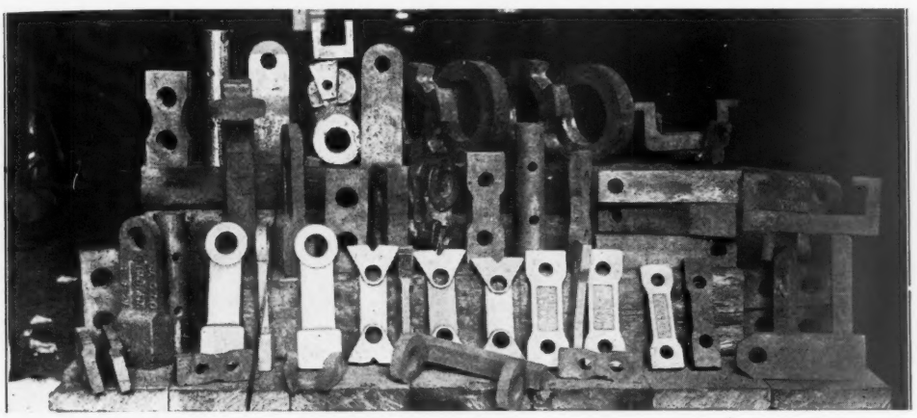

Heads — Mantles
Concaves — Jaws
Cheeks — Gears
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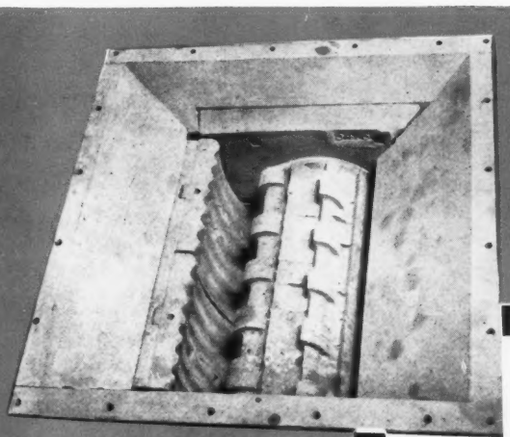
Manganese Steel Department CARLISLE, PENNA.



Looking into the Throat of a Roll Crusher

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After our many years of practical experience in designing and building crushers of different kinds, we think more of our SINGLE ROLL CRUSHER than ever. We are confident that it is the best crusher on the market today for Primary and Secondary crushing. It has the least first cost (capacity considered), least operating cost (no machine nor labor being necessary in feeding), and makes fewer fines or dust. Compact, simple, it will crush without choking, wet, sticky, dry or frozen materials. Used extensively for crushing *cement rock*, limestone, shales, iron ores, coal, gravel, fire clay, phosphate and trap rock, etc.

Special chilled iron mixture for all wearing parts where steel is not used. CAPACITIES UP TO 500 TONS PER HOUR. Wire for complete details and prices.

McLANAHAN-STONE MACHINE CO.
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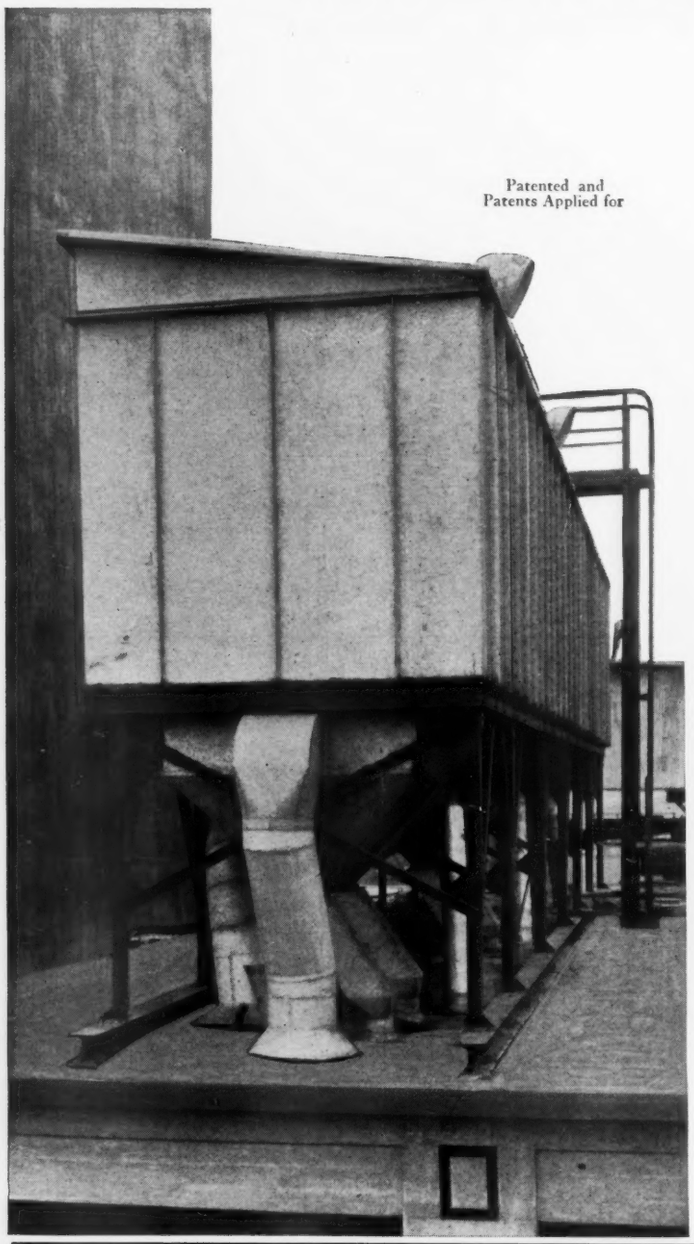
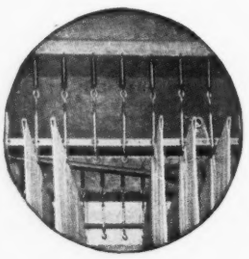
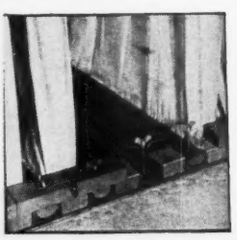
NEW HAVEN
FLAT BAG DUST ARRESTORS



Patented and
Patents Applied for



Each bag has individual spring suspension. Shaking is done horizontally, like snapping a rug, flexing material and removing all dust from cloth.



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Built in multiple units for continuous operation with fully automatic electrical control mechanism.

PARSONS THOMPSON ENGINEERING COMPANY
CLEVELAND, OHIO

LEGAL ADVICE TO NON-METALLIC PRODUCERS

Conducted by Leo T. Parker

The "Why" of Patent Law Protection

First, it is interesting to observe that United States Patent Laws were formulated for the purpose of arousing interest and enthusiasm in persons who are naturally endowed with the inventive genius, so that they might be induced to invent new and improved things adapted to advance civilization and benefit the public. In other words, the patent laws were *not* formulated for the purpose of enabling inventors to hold a monopoly and grow rich from royalties obtained from their patented inventions.

On the other hand, the Courts are careful to protect inventors against unauthorized appropriation of their patents, because without adequate infringement laws, inventors soon would lose enthusiasm to invent new things.

For example, in the leading case of Hurlbut v. Schillinger, 130 U. S. 456, the Supreme Court of the United States rendered its decision on the old patent of laying concrete pavement, by dividing the same in blocks, so that a crack formed in one block wili not continue into the adjacent blocks.

The patent covered a method of placing a strip of tar paper between the blocks at the subdivisions when the pavement was laid.

A person attempted to avoid infringement of this patent by marking off the sections with a trowel and separating the blocks *after* the pavement was laid. He contended that he marked the pavement to give it the appearance of flagging.

However, he was held liable as an infringer, and the Court said:

"The evidence is that the trowel was used to cut through or into the top layer to an extent sufficient to make such a separating of the top layer into blocks, at a line corresponding with the joint below between the section of the first layer, as to control the cracking of the top layer, by dividing it substantially into separate blocks. This division depends upon the depth of the cut. The defendant (infringer) contends that the object and effect of the marking with the trowel was only to give to the pavement the appearance of flagging; but, the evidence is entirely clear, that the cut was made sufficiently deep, in proportion to the thickness of the upper layer, to make such a separation of the upper layer into blocks as would compel any tendency to crack to follow the line of the cut made by the trowel."

Also, it is important to know that in this country the patentee retains a perfect monopoly on his patent although he refuses to offer it for sale or license others to make, sell, or use it. Moreover, he may file suit at any time and obtain a judgment against the infringer for damages and profits.

For illustration, in the leading case of Drum V. Turner, 219 F. 188, an inventor obtained a patent for a concrete flooring and made no effort to manufacture and sell it.

The principle of the invention was to imbed in a concrete flooring a metallic network consisting of strips of beamy wire netting which were laid lengthwise of the building, crosswise of the building, and diagonally in cobhouse fashion and leave only small triangular spaces between four posts free from this metallic network.

Discuss Your Problems

Leo T. Parker, who has decided to conduct the Legal Department for PIT AND QUARRY, is anxious to advise you. There is room in these columns to hear your views. Make PIT AND QUARRY *your* magazine to give it *your* information and answer *your* questions. Names will be used or omitted, as you advise.

A contractor who contracted to construct a building according to plans and specifications infringed the patent during the course of the work. Although the patentee learned of the infringement, he offered no objection to the contractor using his invention. Later the patentee sold the patent to a person who immediately sued the contractor for infringement. The Court promptly held the contractor liable as an infringer.

Liability for Infringement

Generally speaking, the measure of damages for infringement is the profits which the patentee has lost by reason of the unauthorized use of the invention. The amount of the damage may be shown by the owner of the patent proving any acts which the infringer may have done by which the patentee was injured. Such acts may include attempts of sale, advertising the product at reduced prices, or competing with the patentee or his authorized licensee under circumstances by which the latter's anticipated profits are reduced. (152 U. S. 561)

Moreover, additional damages may be allowed by the Courts, where it is shown that the infringement was willful and intentional, and that the infringer persisted in the infringing acts, and displayed determination to fight the litigation with as much delay as possible. In other words, where the infringement is willful the patentee may recover a judgment against the infringer for the profits, *plus three times* the actual damages caused by the infringing acts. (97 U. S. 126)

Also, the Supreme Court of the United States in Elizabeth v. Brown Co., 97 U. S. 126, held that a patentee may obtain the total profits earned by an infringer of a concrete block patent. This Court said:

"It is also clear that a patentee is entitled to recover the profits that have been actually realized from the use of his invention. . . . When the entire profit of a business or undertaking results from the use of the invention, the patentee will be entitled to recover the *entire* profits."

Few persons realize that a basic patent broadly protects the patentee against unauthorized use of any similar or near similar product.

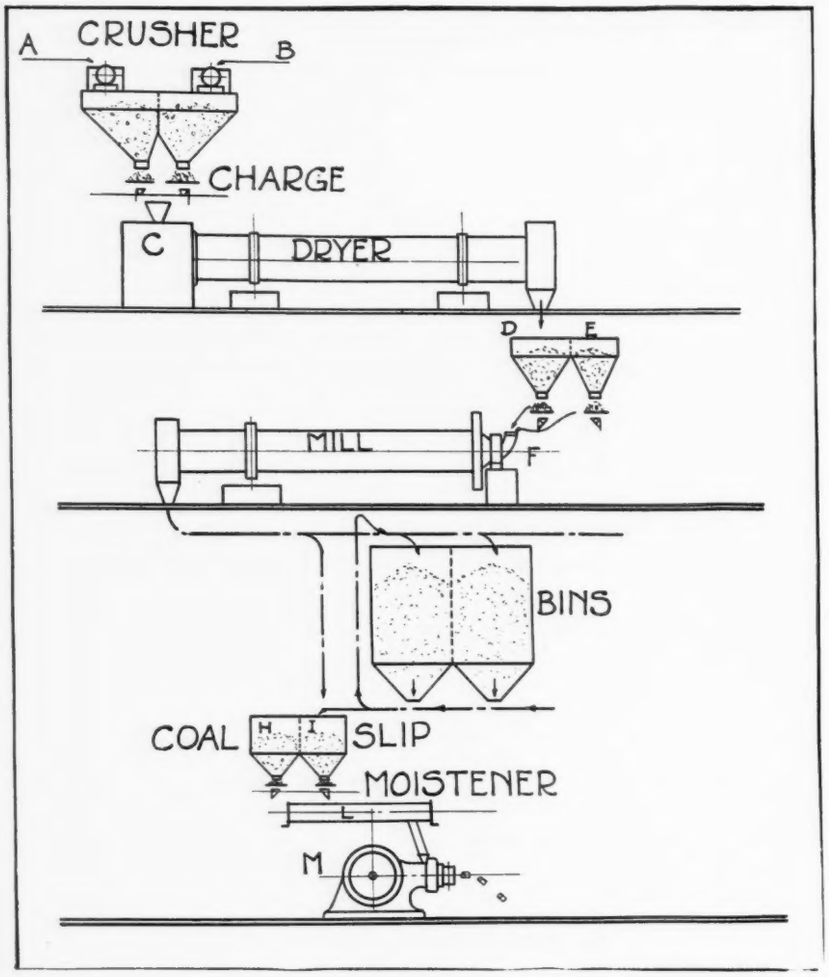
Legal Effect of Basic Patent

For illustration, in American Co. v. Howland Co., 80 F. 395, an inventor obtained a patent on a liner consisting of a layer of cement applied to a wall of tile. The inventor specified that Portland Cement should be used. An unauthorized person constructed a liner using a cement different from Portland, believing that this act avoided infringement of the patent. However, the Court held the patentee entitled to damages, saying:

"His (patentee) claims and description should be construed *as including all cementitious mixtures* which ordinary skilled practical chemists might be expecting to find as answering the requirements of the described conditions, or as such would naturally develop in the growth of the art without invention."

Obviously, therefore, any unauthorized person who uses, makes or sells a patented invention is liable for infringement. This is true although the infringer makes the invention for his own individual use. The same is true where a person infringes a patent by direction of another and without knowledge of the infringement.

PIT AND QUARRY FOREIGN DIGEST



Graph of Shaft Kiln Operation

Modern Cements From Shaft Kilns

Although the rotary kiln is preferred for several reasons for the burning of cement, it is unquestionably true that the fuel consumption of a vertical furnace is only about 60 per cent that of the rotary. This fact alone would make the shaft attractive, the important problem being the securing of a homogenous and uniform product that will compare as favorably with that from the rotary apparatus. In Italy, for example, where there is a supply of natural cement (a naturally occurring raw slip which requires only burning to produce cement) the following procedure, applicable also to artificial slips, has been found to produce a high quality, rapid hardening portland cement. The burning is performed in a shaft kiln with revolving grate. The natural slip is separated according to its lime content into two classes, "High" and "Low" in lime, the former being 79 to 86 per cent, the latter 70 to 78 per cent. The material is first given a preliminary crushing and is then charged mechanically into a rotary drier in the form of large lumps where the moisture content is reduced to less than 1 per cent. The slip passes to a mill which grinds it to a fineness so that not more than 8 per cent remains on a 4,900 mesh sieve. The composition of the ground slip is now corrected by admixture with the necessary ingredients to exactly the composition desired. Sufficient water is added to form a paste which can be molded to briquettes, and these are formed with the addition of a large quantity of coal dust. These briquettes are burned in the vertical kiln with rotating grate, and the resulting clinker carefully ground. In the figure *A* and *B* are the two varieties of slip passing to their hoppers after preliminary crushing. Their water content of 3 to 8 per cent is removed in the rotary drier *C*. The dried material passes through the hopper D into the mill *F* the corrective ingredient be added in hopper *E*. From the bins, the ground slip passes to hopper *I* adjoining the coal hopper *H*. The paste is formed in *L* and the briquettes in *M*.—(*Il Cemento* and *Le Ciment*, March, 1929.)

Hardening Cement and Forming Free Lime

Free CaO was determined by the NH_4 acetate method of Emley and of Lerch and Bogue. Tests with cement H_2O mixtures show that the greater the amount of H_2O, the more CaO is formed. In cement, H_2O, 100:26, CaO began to form only after 5 hours and almost rached the maximum at 8 days, which indicates that at least up to five hours the hardening may be due to formation of $3CaO.Al_2O_3.nH_2O$. Tensile strength does not increase parallel with the amount of CaO formed, which shows that $CaO.SiO_2.mH_2O$ can appear from the supersaturated solution independently of the CaO formation. Only about 1/3 of the $3CaO.SiO_2$ in clinker is decomposed in Cement-H_2O mixtures but mixtures containing sand can have a better efficiency. Calculation shows that if $CaO.SiO_2.mH_2O$ is the chief strength-producing constituent, the final ratio of strengths for a cement-H_2O mixture 100:22 and a cement-sand-H_2O mixture 25:75:12 should be 1:0.85, which agrees well enough with actual values. Hence the sand, beside other functions, acts as a conserver of H_2O, which increases the efficiency of the $3CaO.SiO_2$ in clinker. By powdering and heating hardened cement and putting 1 g. in a mixture of 5 cc. glycerol with 33 cc. absolute alcohol, shaking, heating and filtering, Yamane obtained an opalescent suspension which, with the ultramicroscope showed slowly moving point like particles. Addition of H_2O coagulates it at once. Sigeru Yamane. (Bull. Inst. Phys. Chem. Research (Japan) 7, 1177-90) 1928. C. A.

Weathering Artificial Stone

A weathered or aged appearance is imparted to artificial stone or cement, by applying a layer of soluble material to the surface during the molding process. The soluble substance, such as magnesium sulphate is subsequently dissolved out, leaving a pitted surface on the stone. The pitted surace may be colored and then scraped or brushed. W. Maguire.

INTIMATE NEWS OF MEN AND PLANTS

Ohio Sand Concerns Merge

A merger involving $400,000 and seven Ohio river islands in the vicinity of Youngstown, Ohio, was completed recently when the East Liverpool Sand & Gravel Company and the Eastern Ohio Sand & Gravel Company of Steubenville combined operations under the name of the latter.

Florida Lime Deposits Will Be Worked

Following its purchase of several lime deposits near Chipley, Florida, about a year ago, the Thompson-Williston Mine Company of Jacksonville has bought additional lime deposits in the neighborhood, thus acquiring control of practically all property of that kind in the district. Transportation facilities will be provided by the Alabama and West Florida railroad, which will build an extension to the new plant.

Pontiac Rock Plant Is Now Running

Oliver Buland, owner of a rock-crushing plant northeast of Pontiac, Illinois, has leased a portion of the stone land adjacent to the quarry operated by Pontiac township and has purchased and installed new machinery. In addition to supplying rock for road-building purposes, he will furnish material for all types of concrete and general building uses and limestone for fertilizing. The plant is now in operation.

Lime Company Moves Business Office

The Oregon Lime Products Company will soon move its offices from Portland to Dallas, Oregon. A. A. Muck, Oscar Hayter, Doctor W. L. Pemberton, Guy L. Sully, and Frank Bush are the company's directors.

Winnipeg Firm Changes Name

The business of Braid and McCurdy of Winnipeg, Canada, has been incorporated as the McCurdy Supply Company, Limited, and will deal in builders' supplies and coal. A. G. McCurdy is the company's president; P. G. Hawkins, its vice-president; W. R. Haining, its secretary-treasurer; and Roderick Fraser, its plant superintendent. The company's sand and gravel pit, located at Springfield, about 15 miles from Winnipeg, has a capacity of 500 cu. yd. of crushed-gravel aggregate and 500 cu. yd. of bank-run sand per day. The Winnipeg trade uses bank-run gravel for house foundations and crushed-gravel aggregate for reinforced-concrete work, while bank-run sand is used altogether for brick work, plastering, and the like. Being free from vegetable and loam matter, the gravel and sand found in the vicinity of Winnipeg does not require washing. The crushed aggregate runs approximately 60 per cent ¼ in. to 1½ in. in size and about 40 per cent ¼ in. down.

New Gravel Plant Building In Northern Michigan

A new plant, to be electrically operated and to have a daily capacity of from 600 to 1,000 tons of washed sand and gravel, is being erected at Beechwood, about eight miles west of Iron Mountain, Michigan, by the Champion Sand & Gravel Company, under the direction of M. J. Bacco, its general manager. The plant is situated on a 25-acre tract and will be of approximately the same size as the company's plants near Champion and Lorette, which are now being crowded to capacity. Another plant at Pound will soon be operated on the same basis. It is expected that the Beechwood plant will be in operation before the end of July.

Eastern Silica Plant Adds To Production Facilities

Additional equipment, including a crusher, chaser mill and washers and a 240-hp. Diesel engine, is being installed at the Gore, Virginia, silica-rock plant of the Eastern Silica & Chemical Corporation of Winchester. The production facilities of the plant, which is now running at full capacity, will be increased 150 per cent by the new machinery which is expected to be ready for operation by July 15.

Gravel Plant Produces 55 Carloads Daily

The new gravel washing plant of the Pioneer Gravel Company of Seattle, Washington, at the Northern Pacific pit at Horton, Montana, is in full operation and is delivering to the railroad for use as ballast about 2,000 cu. yd. or 55 carloads of crushed and cleaned gravel daily. Because of its sharp edges, which enable it to cling more strongly to the road bed, the cracked rock mixed with the uncrushed gravel is believed to afford definite advantages to the railroad in its maintenance work. The plant's daily sand output, also taken by the railroad, averages 250 lb. Although the Pioneer company is under contract with the Northern Pacific Railroad to furnish a large amount of treated gravel over a period of years, the total yardage being approximately 300,000, its contracted output for this year can be supplied by late July or early August and it is contemplating accepting contracts for sand and gravel for other than railroad uses when that time arrives. The company's property will furnish an estimated supply for seven or eight years to come.

Twenty to thirty men are steadily employed at the plant, which is situated nine miles west of Miles City, and a number of houses have been built to accommodate them and their families since operations were started in July, 1928. The mechanical equipment includes two steam shovels and an industrial railway with rolling stock consisting of two steam locomotives and a number of gravel cars.

After removal of the overburden by a power shovel, the underlying gravel is removed by a larger shovel and dumped into cars. Trains of 10 and 12 cars carry it to the treating plant, where the sand and gravel are run through a crusher to break up the larger rocks. An endless rubber-belt conveyor carries the crushed material over a big trestle to a large wash box, where water is turned on to it. The gravel and sand are then separated and loaded into cars on a spur built out from the main line. Electric power for operating the machinery is supplied by the Montana-Dakota Power Company, which has built a high-tension line from Miles City to the plant.

Central Supply Buys Hart Brothers' Business

The Central Supply Company of Santa Cruz, California, has acquired control of the Hart Brothers Sand & Gravel Company of that city. The latter's gravel plant will continue to be operated by Frank E. and Donald C. Hart, but under the direct management of George Meserve, Santa Cruz manager of the Central Supply Company. L. F. LeHane of Watsonville is general sales manager of the company.

Asbestos Corporation Names New Officials

The recently adjourned annual meeting of the Asbestos Corporation elected Lieutenant-Colonel R. F. Massie of Toronto, president; Lord Shaughnessy, vice-president; and Honorable Walter Mitchell, Doctor C. W. Colby, J. W. Cook, G. R. Cotterell, Kenneth T. Dawes, Philip S. Ross and H. E. Mitchell, directors.

Signal Mountain Combines Plant Laboratories

The Signal Mountain Portland Cement Company of Chattanooga, Tennessee, is combining all its plant laboratories in a central laboratory in that city, while its general offices will be moved from the plant to the Volunteer building. R. R. Caskey is secretary and resident manager of the company.

Idaho Phosphate Field Will Be Worked

The Idaho American Phosphate Company, which was incorporated last March and owns a phosphate deposit in Bear Lake County near Paris, Idaho, is planning the installation of a mill for crushing and pulverizing the phosphate. Orders that will absorb the entire year's output of the plant are on hand, according to H. B. Dyer, general sales manager, a single order from the Philippine Islands amounting to 100,000 tons. The prevailing price quotation is $22.50 a ton f. o. b. Portland, where the company's sales offices are maintained. H. D. Jackson of Nampa, Idaho, is president and engineer; J. A. Arment of Portland, vice-president; V. S. Rodman of Portland. secretary and treasurer.

New Gypsum Vessels Placed In Ocean Service

Shortly after July 1 the United States Gypsum Company will establish a new passenger and freight service between Philadelphia and Nova Scotia. Each of four new steamships, built in England for the Gypsum Packet Company, a United States Gypsum Company subsidiary, will carry approximately 6,000 tons of gypsum rock from the company's properties in the vicinity of Windsor, Nova Scotia, to Philadelphia, where it will reload general cargo for the return trip. Passenger accommodations for from six to eighteen persons are provided on each ship. Each of the new fleet of vessels is 347 ft. long, 52.8 ft. beam and 23 ft. molded depth, propelled by a single triple-expansion reciprocating engine.

Village Gives Cement Mill Fire Water Facilities

Acting favorably on a request for fire protection made by George Lawniczak, superintendent of the Alpha Portland Cement Company's plant at Bellevue, Michigan, the village council has decided to install an 8-in. water main to serve the property. The Alpha plant is valued at more than $1,000,000.

New Sulphur Operations Begin in California

A 1,500-acre sulphur deposit in the Last Chance range in Inyo county, California, about 25 miles south of Oasis on the Nevada-California line, has been opened by the Pacific Sulphur Company of Bishop. A camp comprising six buildings, including bunk- and boarding-house accommodations for 16 men, has been established and gasoline hoisting equipment and air compressor have been installed. The shaft of the mine has been sunk to a depth of 200 feet, where a crosscut is being driven to determine the extent and value of the deposit. A crosscut opened at the 100-ft. level shows a vein width of 58 ft. with neither wall in sight, the sulphur content averaging 50 per cent. If the product warrants it, a branch railroad may be built from the mine through the Saline valley salt deposits, the Ubehebe lead and copper district, and the Darwin silver-lead mines to a connection with the Southern Pacific railroad at a point near Owens lake. Plant operations are in charge of R. M. McEwan, while the company's office at Bishop is managed by W. B. Montgomery, Jr.

New Corporations.

Travart Stone Co., Brooklyn, N. Y. $10,000. G. J. Rhodins, Jr., 233 Broadway, New York City.

Cavagnaro Sand, Gravel & Tile Co., Northport, N.Y. $10,000. C. J. Masone, 191 Joralemon St., Brooklyn, N. Y.

Edgemont Gravel Co., Dayton, O. $25,000 and 750 shares n.p.v. Harry Heier, W. S. Rhotehamel, L. Edgar Orendorf.

Schellberg Fremont Sand & Gravel Co., George D. Schellberg, Omaha, Nebr. $50,000.

Mallo Sand & Gravel, Inc., Netcong, N. J. $100,000.

Platte Sand & Gravel Co., Nebr. $35,000. Chas. H. Yost, Carl A. Manska. Will begin pumping operations at Leshara, Nebr.

Acme Gravel, Sand & Material Co., Miss. $75,000. F. T. Payne, S. A. Gans, A. H. Alvis.

Nicolet Asbestos Mines, Ltd., Montreal, Que., Can. $50,000.

Consolidated Marble Corp., c/o Harry Fischman, 10th St., Allegheny Ave. and Westmoreland St., Philadelphia, Pa. 100 shares com. Marble, slate, granite.

Wisconsin Block Granite Corp., Wausau, Wis. $10,000. Chas. E. Ninneman, Herman Ninneman, 809 S. 11th Ave.; V. W. Callaway.

Colloidal Phosphate Holding Co., J. F. Hughes, 50 Broadway, New York City. 100 shares com.

Gray's Ferry Brick Co., 5th & Chestnut Sts., Lebanon, Pa. T. T. Lineaweaver, Treas.; Grant W. Lineaweaver. Will build sand-lime brick plant.

Portland Sand & Gravel Co., R. 1, Box 185, Portland, Ore. L. E. Craswell.

Miami Cement Products, Inc., Hamilton, O. $10,000. Henry Wiecehe, Carl Frechtling, Walton S. Bowers. To produce washed sand and gravel and crushed gravel.

Bristol Sand & Gravel Co., Wistar & Reading R. R., Philadelphia, Pa. 2000 shares com. Martin F. Connor, Pres.; Martin F. Connor, Jr., Sec.

Connecticut River Stone Products Corp., Box 290, Middletown, Conn. $100,000. E. P. Decker, Pres., 31 Nassau St., New York City; G. L. Baldwin, V. P. & Gen. Mgr.; A. B. Hubbell, Sec.-Treas., both Middletown, Conn.; A. W. Berresford, 1 Fifth Ave., New York City. Will produce crushed stone.

National Stone Quarries Corp., Albany, N. Y. $450,000. Robert C. Killough, Jr., 211 Seventh Ave., Watervliet, N. Y.; Chas. M. Collier, Atlanta, Ga.; Joseph J. Casey, 45 Fleetwood Ave., Albany, N. Y.; C. J. Tobin, Albany, N. Y. To quarry stone.

Black Rock Mining Syndicate, 525 New York Life Bldg., Minneapolis, Minn. $500,000. John Gorrien, William Siegmann, Anthony M. Bayer. To produce graphite, mica, granite, asbestos, lead, and zinc.

Natural Rock Asphalt Co., St. Louis, Mo. 200 shares, $100 each pfd.; and 300 shares com. n.p.v. To quarry rock asphalt. Lowell Sparling, 1109 International Life Bldg., St. Louis; James Austin, Jr., Kirkwood, Mo.; John D. Coffman, St. Louis.

LeRaysville Stone Co., LeRaysville, Pa. $10,000. W. Ernest Brown, Treas., LeRaysville; N. C. Tiffany, Nicholson, Pa. To operate quarry.

United Mica Corp., Grant Lowe, V. P. & Treas., Sylva, N. C., formed to take over Ruben Mica Co., Sylvan, N. C. Will erect sheet mica, and grinding plant. Philip Godley, Pres., 23 Queen St., Philadelphia, Pa.; Frank Jarrett, Sec., Dillsboro, N. C.

NEWS OF EQUIPMENT MANUFACTURERS

Worthington Announces New Compressors

A new series of single, horizontal, straight-line compressors of capacities ranging from 100 to 300 cu. ft. per minute has been announced by the Worthington Pump & Machinery Corporation. Timken roller bearings are employed on the main crank-shaft journals, oil rings to catch the surplus oil and return it to the oil-tight crank case being mounted on the shaft beyond the roller bearings. Feather valves, which are standard equipment on these machines, are light strips of steel, approximately 1/32 in. thick, which flex when opening against a curved guard to allow the passage of air. Regulation can be had either by an automatic starter and pressure switch mounted on the motor, stopping and starting it to control the air pressure between definite limits, or by a pressure regulator attached to the compressor inlet valves, holding them open to maintain constant air pressure. These compressors can be furnished with ball-bearing idlers for short belt drive or with Texrope drives having V-type ropes, or a synchronous motor can be connected direct to the compressor crank shaft, thus eliminating transmission mechanism.

Krohn Differential Locates At Buchanan, Michigan

W. G. Farnsworth, president, Krohn Differential Corporation, announces that enlarged production facilities have been procured for the manufacture of Krohn compensating differentials at Buchanan, Michigan. The plant obtained is that of the Campbell Transmission Company which is fully equipped for quantity production and has fourteen acres of ground adjoining on which added plant facilities can be built.

Stephens-Adamson Appoints Birmingham Manager

The Stephens-Adamson Manufacturing Company has announced the appointment of H. W. Newton as district manager of the Birmingham, Alabama, office to succeed W. E. Harris who is no longer affiliated.

Mr. Newton has a broad knowledge and experience in the material handling field and has been connected with the S-A Manufacturing Company for several years in the capacity of designing engineer. Quick apreciation of a customer's requirements and an expert understanding of modern methods fit him especially for this sales engineering work with those within his territory.

He will have his offices at 1108 Martin Building and will welcome an opportunity to meet old S-A customers and prospects. In having previously lived in the south for many years, Mr. Newton already has a wide circle of acquaintances which should steadily grow with his new association.

In placing Mr. Newton in charge of this important district office, the company is adhering to its standard policy of appointing men of technical training and engineering experience to sell its line of material handling machinery. These engineers are acting in the capacity of salesmen yet their engineering qualifications equip them to offer assistance in the handling of equipment problems.

Steindorf Transferred

R. T. Steindorf, assistant to W. B. Marshall, conveyor sales manager of the Chain Belt Company, has been transferred to the Cleveland Office at East 200th Street and St. Clair Avenue. Mr. Steindorf has been with the Chain Belt Company since graduation at Purdue University in 1924. He first worked as student apprentice, and later was connected with several of the company's branch offices.

Messinger Elected Director Of Gas Light Company

C. R. Messinger, president of the Chain Belt Company, was elected a director of the Milwaukee Gas Light Company, part of the American Light and Traction Company of New York. Mr. Messinger is also a director of the Sivyer Steel Castings Company, Federal Malleable Company, and Interstate Drop Forge Company of Milwaukee, which are affiliated with the Chain Belt Company. He is also a director of the Nugent Steel Castings Company of Chicago.

Transit Concrete Builds Plant In Record Time

The illustration shows the largest concrete structure in the East Bay District of California, utilizing 14,000 cubic yards of transit system mixed concrete, supplied by The Hutchinson Company of Oakland, California. On this six story reinforced concrete

Plant Being Constructed with Transit-Mixed Concrete

structure, six Paris transit mixers, pouring at several points on the job, supplied 25,000 lb. strength concrete and completed the pour in record time.

The contract for this building was in the hands of MacDonald and Kahn, Incorporated. The General Electric architects designed the structure. The necessary concrete tests were made by the Robert W. Hunt Company, concrete technologists of Oakland.

New Business Formed

Chester A. Phillips, who was formerly associated with the Osgood company, announces the opening of a business under the name of Chester A. Phillips and Company with offices at 37 West Van Buren Street, Chicago. The firm will handle new and used quarry, marine, contractors', railroad and industrial equipment.

Crushers and Rolls Discussed

The Kennedy Van Saun Manufacturing and Engineering Company is distributing a 6-page illustrated folder. This folder briefly describes the gyratory and jaw crushers and the standard heavy duty slugger rolls. In addition the apparent purpose of the folder is to show that these products have a world area of uses under varied conditions. Quite a number of photostats of letters are shown as well as a number of excerpts that are of considerable interest.

A Foote Note

Foote Bros. Gear and Machine Company has announced the appointment of S. Howard Eisenberg, as district representative for the States of Colorado, Wyoming and New Mexico, replacing F. Ross Eberhard. Mr. Eisenberg has established headquarters at 2812 Ash St., Denver, Colorado, and is now in a position to cooperate with the companies in his territory on any of their problems.

A New Unloader

Nelson Designs New Loader

A new loader for contractors and road builders has been designed by the N. P. Nelson Iron Works as the Type Q-7, and is being manufactured to meet the exacting requirements of road construction and similar work. The power unit is the McCormick 10-20 tractor with a special gear drive to the crawlers. The crawlers themselves are unusually long, giving a steadier cutting plane and less rocking-chair effect than is usual in crawler-mounted machinery. Shoes are alloy steel with hardened pins.

The elevating capacity is over two yards a minute, and the continuous spiral feeders have power enough to tear up macadam. Depth of cut is regulated by handwheel at the platform. The swinging cleanup scraper is also adjustable and a handwheel on the boom turns the long discharge chute.

Protection to the operator is afforded by the closed-in boom panels, high sideboards and a canopy. The chassis sides are also paneled to exclude dirt from the machinery.

The machine is well balanced and suitable for all phases of highway work—macadam removal, stripping, subgrading, batching in sand and stone, stockpile work and sand or gravel pit loading. Batchers up to 1¼-cu. yd. capacity can be furnished.

Tractor Corporation Elects Officers and Directors

Milton W. Anderson, of Chicago, was re-elected president of the United Tractor & Equipment Corporation, comprising forty prominent makers and distributors of tractors, farm implements and industrial equipment, at the annual directors' meeting, held June 19 at Milwaukee. W. B. May, president of W. B. May, Incorporated, Buffalo, New York, was elected vice-president; E. R. Wehr, vice-president of the Wehr Company, Milwaukee, was elected secretary-treasurer, and H. T. Enns, Jr., Chicago, was made assistant secretary-treasurer. Directors were elected at the stockholders' annual meeting in Chicago, June 18, as follows: H. C. Merritt (Allis-Chalmers Company), Walter H. Stiemke (Trackson Company), and E. R. Wehr (Wehr Company), all of Milwaukee; Arthur S. Hughes (Hughes-Keenan Company, Mansfield, Ohio); Dunbar Abston (Dealers' Equipment Company, Memphis, Tennessee); A. W. Logan (Motor Power Equipment Company, St. Paul, Minnesota); C. V. Ruble (Universal Equipment Company, Kansas City, Missouri); W. B. May (W. B. May, Incorporated, Buffalo, New York); and Milton W. Anderson.

Election of the officers ended a day spent by stockholders and directors from twenty-two states and Canada inspecting various products of the United line, and in going through the newly-completed special factory in which the Allis-Chalmers Company, a United corporation member, on August 1 will begin increased quantity production of the United tractor for the other members of the corporation.

"Developments of the past few months have amply demonstrated the soundness of our co-operative manufacturing and marketing plan, backed by the $125,000,000 joint assets of our members," said President Anderson, who left a distributorship in California somewhat more than a year ago to organize a nationwide movement for the co-operative making and selling of a full line, following Henry Ford's abandonment of the tractor field in this country. "We have applications for membership from various outstanding manufacturers and distributors, and are steadily adding to our dealer organization."

Represented with demonstrations at the proving grounds were the Allis-Chalmers Company with the United tractor; the Trackson Company with its crawler attachment for the United; the Wehr Company with its United road grader; the Moline Implement Company with the United plow; the Centaur Tractor Corporation with a tractor; the Perry Company showing scrapers; and the I. B. Rowell Company exhibiting feed grinders and silo fillers.

Page Engineering Distributes New Bulletins

The Page Engineering Company is distributing several illustrated bulletins which describe the Page buckets, dragslips, slackline cableways and drag shovel attachments. Bulletin 300 consists of 4 pages and is concerned with Page buckets, together with a history of their development and a description of their mechanical and physical construction.

Bulletin 400 consists of 20 illustrated pages, devoted to the description of buckets of ⅜- to 2-cu. yd. capacity, including trench buckets, dragslips and drag shovel attachments. In this bulletin, many concrete examples are shown, together with a description of the different parts. Recommendations are included as to the most efficient design for a particular class of work and including a note referring to Bulletin 500 for information on heavy and large buckets. This publication is an illustrated 12-page description of the heavier types from 2½-cu. yd. to 10-cu. yd. capacity and calls particular attention to the construction and uses of these buckets.

Bulletin 600 is concerned with repair parts and export information. It is pointed out that the company maintains a stock of repair parts ready for shipment on notice by wire. It appreciates the value of time and makes every effort to keep equipment operating by shipping repairs correctly and quickly. Bulletin 700 illustrates and describes the uses of slackline cableways and shows their advantages. The Page slackline cableways are built in various sizes to suit conditions of varying spans and required output.

Ready-Mixed Delivery Tank

The Portland Concrete Machines Company is distributing an illustrated 6-page circular that describes the R. M. C. delivery tanks. Owing to the progress and rapid development of the ready-mixed concrete industry, this company has designed a special tank for delivering the concrete without alteration or change. There is said to be no loss of the concrete, delivered 2 or 3 hours from the mixing plant.

For Your Safety Program

The Mine Safety Appliances Company is distributing Catalog No. FA-1 to those interested in all types of safety appliances for the Pit and Quarry industries. The publication, which consists of 32 pages, is profusely illustrated and gives the uses and prices of each type of equipment. In addition to the equipment in the catalog, it lists different charts for the purpose of illustrating safety talks. These charts are of considerable value to employees when displayed in public places.